Measuring Externalities of Low-Income Housing Tax Credit (LIHTC) Projects in Property Value of Neighborhood Single-Family Homes: A Case in Austin, Texas

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Abstract

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Since the Tax Reform Act of 1986, Low-Income Housing Tax Credit (LIHTC) has been a major source of affordable housing provision for low to middle-income families. Meanwhile, growing concern about potential decrease of property value in neighborhoods has been the main obstacle for most of the affordable housing projects. As a result, LIHTC projects are facing backlash from neighborhoods near the potential affordable housing projects – NIMBYism (Not In My Back Yard). However, during decades, it has been always controversial whether LIHTC is actually affecting neighborhood property value in negative way.

This study tests the hypothesis that the LIHTC projects affect negatively on neighborhood single-family home property value in Austin, Texas. Single-family homes within 2000-feet radius from the selected LIHTC projects were analyzed based on the Travis County Appraisal District annual appraisal values between 1993 and 2008.

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Chapter1: Introduction

Housing is indispensable for one's life. Every individual should have housing at the minimum standard by every individual regardless of their income level. In other words, housing cost is a fixed cost which determines the individual disposable income. If someone is burdened with excess housing cost, consumption for other services and goods decreases. Especially, inability to pay for social services– health care or education- can lower the quality of life of individuals significantly.

The Department of Housing and Urban Development (HUD) defines 'affordable' housing as dwelling units costing less than 30 percent of annual household income.[1] According to the U.S. Census American Housing Survey 2005,[2] approximately 35 percent of households in United States were burdened by housing cost of more than 30 percent of their income.[3] More striking is the contrast between owner-occupied housings and renter-occupied housings. Fifty-four percent of renters in the United States are spending more than 30 percent of their income on housing costs while only 28 percent of homeowners are housing cost-burdened (Table 1.1).[4] The proportion of housing cost in household income means not only the ability to pay for their housing but also the quality of life they can pursue within the limited amount of income.

There have been a lot of efforts by the federal government, to meet the national demand for affordable housing options. Federally-initiated affordable housing programs started in 1937 in the form of construction projects as it was the fastest and easiest way of increasing the affordable housing stock and stimulating the economy under the Great Depression. Project-based programs continued to grow as a major method for meeting the increasing demands for affordable housings.

For reasons discussed in chapter 2, project-based affordable housing programs was replaced by the tenant-based programs such as Section 8 Housing Choice Voucher Programs. Instead of government construction of public housing, however, the Tax Reform Act in 1986 provides tax credits for rehabilitation, new construction or acquisition of existing buildings for affordable housing projects mainly for low- and moderate-income families. Today the Low Income Housing Tax Credit (LIHTC) program has become the primary source of low-income housing in the United States.

Table 1.1 Number of Housing Cost-Burdened households in the United States

Percentage of monthly housing cost in current household income	Total	Owner-occupied	Renter-occupied
Less than 30%	67721	53458	14264
30% or more	37180	20630	16550
Total	104901	74088	30814
Housing Cost-burdened Households (%)	35	28	54

Source: *U.S. Census Sample File 1* (2000).
Note: All numbers are in thousands unless indicated separately.

CRITICISM TOWARD AFFORDABLE HOUSING PROJECTS AND LIHTC

Affordable housing projects are frequently accused of decreasing the value of the adjacent properties by worsening the conditions of neighborhoods. As the demand for affordable housings are generated mostly from households with lower-income, affordable housing properties tend to be located in areas where the demands are – i.e. low-income residents concentrated areas. It has been criticized that affordable housings located in low-income areas are causing segregation between the individuals with different income levels. Also, they are allegedly decreasing the property values by bringing negative changes in their neighborhoods. The detrimental effects caused by affordable housing projects are usually considered having "spillover effect." The alleged negative changes

include increase of crime in the area, racial transition, poverty concentration and decrease in property value. Most of all, change in property value is the biggest concern of neighborhood homeowners. They believe that all the other side effects of having a low-income housing project nearby are eventually led to the decrease in their own property value.

The resistance toward affordable housing projects is often depicted as NIMBYism (Not In My Back Yard), negative reaction toward new developments or constructions nearby due to the fear of abrupt change of the neighborhood. The fear of decrease in property value due to the concentration of low-income families and its spillover effect in the immediate neighborhood is the main factor of NIMBY which develops from the individual level backlash to the institutional and political barriers. LIHTC program is not immune from NIMBYism. LIHTC projects face the opposition of neighborhoods in the actual development stage after being selected as a tax credit project. Most cities in United States require new developments to comply zoning regulations and change of zoning can only be authorized by the City Council, which is under the clout of neighborhood associations, interest groups and immediate neighbors of the potential projects.

Even though LIHTC is one of the biggest affordable housing programs in the history of federal housing policy, it is criticized as other previous affordable housing programs. It was designed about 20 years ago when HUD and other government entities were not well aware of the concept of 'deconcentration' of poverty in evaluating housing programs.[5] Therefore, it is not reasonable to let the program take responsibility for concentration of poverty in immediate neighborhood; however, it is reasonable to measure to what extent the program has contributed to the change in neighborhood property value which is considered 'outcome' of the concentration of poverty by new housing projects. Also, by measuring the impact of the LIHTC program on neighborhood

residential property values, it is possible to figure out how the program can mitigate the oppositions of potential neighborhoods.

PURPOSE OF THE STUDY AND RESEARCH QUESTIONS

The main purpose of this study is to identify the effect of LIHTC projects on neighborhood single-family housing property values in Austin. The hypothesis LIHTC projects have negative effect on the property values of neighborhood single-family homes in Austin, Texas,' is tested using multivariate regression analysis based on the appraised property values of single-family homes during 13 years – from 1993 to 2008 which are built in between 1995 and 2006. The study is limited to Austin Urban Area defined by U.S. Census 2000 to reflect the geographical and socioeconomic characteristics.

Several secondary questions related to the LIHTC projects and its neighborhoods will be answered throughout the analysis. First, can the serving population of LIHTC projects have any impact on the change of single-family housing property values? Second, how the percentage of affordable housing units in LIHTC projects affect the single-family housing property values nearby? Third, does the effect of LIHTC properties in single-family property value vary along the distance within 2000-feet radius? Answers to those questions will produce policy recommendations for implementing LIHTC programs. The overall process of this analysis will help understanding the consequences and externalities of LIHTC projects in their adjacent neighborhood. Furthermore, observing the significant variables from the regression analysis will provide policy options to minimize the possible negative externalities to mitigate NIMBYism in designing process of affordable housing policies in the future.

This report examines at the LIHTC projects and their impacts in immediate neighborhoods in Austin, Texas. The first chapter introduces the birth of LIHTC program

and its purpose in context of history of the federal affordable housing policy and NIMBY, the biggest obstacle in implementing the policy is discussed. The second chapter presents the socioeconomic characteristics of Austin, Texas in spatial context. From the third chapter, the methodology and the result of regression analysis is described. Finally, policy implications from study and suggestions for the future study are presented.

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Chapter2: Historical Background of Federal Affordable Housing Policy

Since 1937, federal housing policy has provided affordable housing options for extremely-low to moderate-income households, through the programs by several federal agencies and later by the U.S. Department of Housing and Urban Development (HUD). The history of federal affordable housing policy is framed by four key legislations – Housing act of 1937, Housing and Urban Development Act of 1968, the Housing and Community Development of 1974 and the Tax Reform Act of 1986. Along the several legislations between 1937 and 1986, there had been transitions between project-based and tenant-based projects.

Project-based affordable housing programs were designed to assist affordable housing projects by providing federal grants in various forms such as direct funding or providing mortgage insurance. Project-based programs enlarged the overall supply of affordable housing units. However, they worsened socioeconomic and racial segregation by concentrating low-income families in undesirable parts of a city. As a solution for the side effects of project-based programs, tenant-based programs replaced a majority of the new affordable housing supply since 1974. They are distinguished from project-based programs as HUD subsidizes eligible tenants and let them choose where to live and pay below-market rent instead of funding multifamily housing projects. It mitigated the concern about the concentration of poverty caused by project-based housings but increase in supply of affordable housing could not keep up with the increasing demand for affordable housings. To accomplish both increase of affordable housing stock and social mix, Low Income Housing Tax Credit (LIHTC) program was established by the Tax Reform Act of 1986.

INCEPTION

The very first project-based affordable housing policy was the Public Housing program by United States Housing Authority (USHA) established by the Wagner-Steagall Housing Act of 1937. The program started providing loans for low-income affordable housings to solve the social problems and rehabilitate the neighborhood. By 1942, USHA had supported building 100,000 units in more than 140 cities throughout the nation.[1] After World War II, Housing Act of 1949 revived the public housing policy. Public Housing Authorities (PHA) were established in city and county levels to administer the federal grants from federal government for providing affordable housings for extremely low-income households or those who are displaced from their places due to urban renewals.[2] Following the emphasis on urban redevelopment and "slum clearance"[3] in the period, new affordable housing projects replaced the dilapidated housings in slums. PHAs built new properties or rehabilitated old and abandoned properties into affordable housing units.

Most affordable housing properties were either clustered single homes or multifamily housings. Also, it is often suspected that the Great Migration of African American population to northern or western cities encouraged policy makers to abuse the public housing program to put barricade around the white neighborhoods.[4] It created "locational stigma"[5] on public housings and it became inevitable to site them in undesirable part of the neighborhoods. Public housing projects have been highly criticized for aggravating the concentration of poverty and deteriorating physical and social condition of their immediate neighborhoods. Consequently, public housing programs deprived the upward mobility of low-income households by blocking them from residing in decent neighborhoods with better-quality educational opportunities and access to more employment information. The criticism toward the negative consequences

of the project-based programs called for a new stream of policy which will assuage the spatial concentration of low-income families and individuals.

TRANSITION

After 1968, federal affordable housing policy changed the direction drastically by adopting a series of new programs to deconcentrate affordable housing units. It had changed from project-based programs to Scattered Site Housing Program, and to tenant-based programs. One stream of programs is called Scattered Site Housing Program (SSHP).[6] Section 236 program, which was one of the SSHP, was initiated as a part of the Housing and Urban Development Act of 1968. The program subsidized mortgages to nonprofit or private developers for affordable housing developments with mixed-income apartment constructions for low and moderate income households. Even though the programs are in a form of project-based subsidies, they allowed the tenants to reside in better neighborhoods than the typical neighborhood where most public housings are located.

Later on, HUD set off a tenant-based program: Section 8 Certificate and Housing Choice Vouchers Program. Initially, the Housing and Community Development Act of 1974 created the Housing Certificate Program as part of the Section 8 programs. The program was designed to integrate low-income families into the neighborhoods with different income level by giving them wider residential choices. Tenants would pay 15 or 25 percent of their income, later raised to 30 percent.[7] They could only rent the properties at fair market rent (FMR) designated by HUD.

In 1983, through the Housing and Urban-Rural Renovation Act, Section 8 Housing Voucher Program was initiated. To give more flexibility in choices of location and rent level, two major aspects were added to the Housing Certificate Program.[8]

Eligible households could receive vouchers and choose any rental units either within or outside of jurisdiction the vouchers were issued. Also, tenants pay 30 percent of their adjusted household income on top of the voucher as rent and PHAs redeem the vouchers for landlords – usually 80 percent to 100 percent of the FMR determined by HUD.[9]

It allowed eligible families to rent more expensive units than the FMR so that they could have more housing choices. Some project-based Section 8 units were built and operated by PHAs – public affordable multifamily housings accepting Housing Choice Vouchers. In 1998, the Voucher program and the Certificate program were merged into one program to eliminate the redundancy and complications which come from the coexistence of both programs. Since 1974, Section 8 has been playing a major role in providing affordable housings – as of 2000, about 1.5 million tenants have received rent subsidy through Section 8 program.

THE BIRTH OF LIHTC

While Section 8 became the prevailing tenant-based program, HUD continued to put effort on increasing affordable housing stock. The Low-Income Housing Tax Credit (LIHTC) was a federal subsidy for affordable housing projects created by the Tax Reform Act of 1986. The act provides tax credits for rehabilitation, new construction or acquisition of existing buildings for affordable housing projects mainly for low- and moderate-income families. To be eligible for the tax credit, developers have to allocate either at least 20 percent or more of the units for households with no more than 50 percent of area median income (AMI) or at least 40 percent for households with less than 60 percent of AMI.[10]

Unlike other affordable housing subsidies, LIHTC is not directly administered by HUD. As part of the permanent tax code (Section 42), U.S. Treasury allocates funding for

the LIHTC each year to local governments. Internal Revenue Service (IRS) and local housing financing agencies jointly administer the program.[11] IRS allocates the credits to states on per-capita basis; $1.75 per capita for each state after inflation adjustment.[12] Private developers can apply for the tax credit through local housing financing agencies which are designated to administer the LIHTC program in their state. The criteria include not only the percentage of set-aside units for affordable housing but also location in the area – projects within Difficult Development Area (DDA) or Qualified Census Tract (QCT) can be prioritized among the applicants. QCTs are the census tracts either with 50 percent or more households having an income less than 60 percent of the area median gross income (AMGI) for the certain year or with 25 percent or more households in poverty. DDA refers to the area with high construction, land and utility costs compared to its AMGI. DDAs are eligible for 130 percent of qualified LIHTC basis which can cover majority of the development costs solemnly by the tax credits. In addition, there are other non-point based factors such as financial portfolio, feasibility of the construction, development experience, and site conditions.

The maximum gross rent for affordable housing units, including utilities, is restricted to 30 percent of maximum income of qualifying households. The LIHTC developments are mandated to preserve affordable housing units as low-rent units for fifty years to comply with the restriction of the program. If they fail to comply with the restriction, their used tax credits can be recaptured by the federal law.[13]

LIHTC has several purposes. First, it was established to increase the overall supply of affordable housings for households. Since its inception, the LIHTC has provided subsidies to the development of more than 1.5 million affordable housing units.[14] It apparently enlarged the volume of affordable housing provision nationwide. Second, the program aims to induce efficiency and a ‘bag of tricks’ for building rental

housings from private market. It can stimulate the participation of private sector in affordable housing market and public-private partnership.[15] Also, under the assumption that mixed-income housing projects can mitigate the backlash from the neighborhoods against the affordable housing projects, the tax credit is designed to foster social and income mix 'within' the properties systematically. Unlike the public housing programs built exclusively for extremely low to low income households, the LIHTC projects have more variety in income level of served population. As mentioned above, to be qualified for the tax credit, the LIHTC projects have to preserve certain proportion of units 'affordable' while other units can remain at market rent.

Once the tax credit is allocated, the project should follow the zoning regulations or corresponding rules which is required to real estate developments by city government in most cases. The process incorporates the opinion of the city council, neighborhood associations and immediate neighbors of the potential projects. HUD suggests that the developers should negotiate with the neighborhood through the public hearings or community meetings in the development process. Local neighbors usually attend the meetings or interact with the developers directly to express their concerns and opinions on the major change in their community. Throughout the process, the major hardship the most projects face is the rigorous backlash of the immediate neighborhoods, mainly based on their NIMBYism.

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Chapter3: NIMBYism and Affordable Housing Projects

NIMBY ("Not In My Back Yard") syndrome is an expression of fear of change in the characteristics of the community to certain level of growth, certain type of development or economic, racial and ethnic heterogeneity.[1] It initially starts out in individual level of backlash toward the changes in physical environment or racial composition of the community. Consequently, it grows into a form of collective social or political action which result local controls or regulatory barriers. Most commonly, NIMBY refers to the abhorrence toward "obviously negative" facilities such as shelters for homeless, group homes for AIDS patients, sanitary landfills, incinerators, prisons or airports.[2] Communities do not want to take a risk of increase in vandalism, unpleasant odors, influx of people from outside of the community or tremendous amount of noise which can decrease their quality of life. Furthermore, communities are against almost all kinds of new housing developments in their immediate neighborhood.

Even though most communities in U.S. are in need of more housing, already established residents have long been averse to new housing projects.[3] Additional housing in the neighborhood creates pressure for public services and amenities in the community – schools, transportation, water supply, parks and so on. In addition, investment in infrastructure following the growth of the community becomes a tax burden for established residents. Moreover, expenditures on infrastructure and State or Federal social welfare mandates can compete for priorities in local governments.[4] As a result, it became inevitable for local governments to increase property tax, the major source of revenue. The tax burden will directly affect local residents which will be led to the negative response toward the new housing developments. Those consequences of new residential developments have incited the backlash by the communities.

The resistance gets even worse when it comes to locating government-assisted affordable housing projects than market-rated housing projects. Individuals, especially single-family home owners, are afraid that construction of new affordable housing projects can change the neighborhood detrimentally. They are concerned about the possible externalities such as increase in crime, concentration of poverty, racial or ethnic heterogeneity and decrease in their property value.[5] Fear toward the possible decrease in the property value of single-family housings in surrounding area of low-income affordable housings is the major factor of NIMBY. Established neighbors tend to perceive the tenants of affordable housings as individuals with lower income than their neighbors who cannot afford to move in the neighborhood normally.[6]

Why has NIMBY become an issue in affordable housing developments for low-income individuals? It stems from the strong stigmatization toward the public housings built by housing authorities since the Wagner-Steagall Housing Act of 1937. Public housings are known as the oldest and highly stigmatized than other project-based affordable housings.[7] United States Housing Authority (USHA), established in 1937, provided public housings for low-income families in slums under the assumption that building decent housings in slums can eradicate the urban social ills such as crime, delinquency or diseases.[8] While more than three fourths of Americans were living in single-family homes, most of the public housings were built as multi-storey modernist style buildings which made them look distinctive from other residential areas.[9] Being located in unwanted part of the neighborhoods and occupied by the low-income households with various types of urban social ills stigmatized the very first trial of federal affordable housing program. Other types of assisted housing developments following the public housing programs became notorious as a clearinghouse of "crime, disorder and despair".[10] As a result, the negative perception toward public housing and few previous

affordable housing manifests the public that all project-based affordable housing projects will affect their neighborhood detrimentally.

NIMBYISM TOWARD AFFORDABLE HOUSING PROJECTS

NIMBY toward the affordable housings can also be explained in sociological context. American individualism emphasizes that people ought to be "self-reliant" and go after all the possible opportunities for upward social mobility.[11] In the nineteenth century, impoverished individuals were classified into two categories - deserving and undeserving poor. The former can be replaced as "able-bodied" poor while the latter means "impotent" poor.[12] Undeserving poor means the people relying on the public assistance or charity that are against the rule of self reliance and too lazy to take advantage of the opportunities. They have been depicted as a group of people being clustered in urban slums and deteriorating the quality of life of middle class and deserving poor in the area.[13] Due to the perception toward the social welfare support recipients, residents of low-income affordable housings are stigmatized as undeserving poor and undesirable neighbors. Moreover, in American society, one's neighborhood characterizes their socioeconomic status. Living in an exclusive and desirable neighborhood is an indicator of their high status in social hierarchy.[14] Established residents near the potential affordable housing projects, especially in the area with higher property value or median income, assume that the low-income households will devalue not only their properties but also their socioeconomic status.

NIMBY AND LIHTC PROJECTS

Why do we care about NIMBY in implementing LIHTC projects? Due to both physical and psychological stigma toward affordable housing projects, NIMBY has been

a major obstacle for implementing affordable housing projects serving low-income or elderly population. It became a major force which should be taken into account in the process of developing affordable housing policies.[15] The problem becomes acute as NIMBYism does not stay at just the individual level – it gives pressure to municipal or state governments to create regulatory barriers to prevent possible affordable housing projects in their neighborhood. Recognizing the magnitude of the problem, HUD has been addressing the issue of regulatory barriers toward affordable housing projects through the Advisory Commission on Regulatory Barriers to Affordable Housing since 1999. The individual and institutional NIMBY deters the increase of affordable housing nationally. Moreover, spatial concentration problem of affordable housing in low-income areas cannot be solved as long as NIMBY exists. Even though NIMBY is a common response to any kind of new affordable housing projects, it usually comes from their psychological reaction, fear, without any solid evidence.

Austin is not an exception – there have been discussions and criticisms on the NIMBY toward affordable housing projects. Austin-American Statesman depicted the influence of NIMBY on City Council as below,

> Nonetheless, the NIMBY affordable housing bug appears to have spread to the pro-neighborhood City Council. Recently, a majority of council members added requirements to a proposed mobile home project in Southeast Austin that makes it more difficult to develop. A majority also opposed an affordable apartment complex in Northeast Austin, after residents complained that it would cause crime. – *Austin-American Statesman, 1997*[16]

In practice, there were series of protest against LIHTC projects in Austin in 1998. Trails at the Park and Village of Oak Creek were the two LIHTC projects authorized to be built and faced rigorous backlash from their neighborhoods. It was assumed that the protests were mainly due to the stereotype toward lower-income families.[17] Recently, in 2008, there was a nonprofit organization attempting to build a 110-unit affordable

housing complex in northeast Austin to serve homeless people and low-income families. The Northeast Austin Business and Community Alliance, a neighborhood interest group, opposed to the proposal as they strongly believe that "the project will attract crime and negatively affect the quality of life in the area." The Windsor Park Neighborhood Association claimed that there is a valid petition of over 62 percent of surrounding property owners. [18] Establishing the project will not get easier as it requires a supermajority council vote to override the neighbors' petition against it and allow rezoning the site for the multi-family affordable housing project. [19]

To persuade public to be open-minded for new affordable housing projects, it is important to prove that there is no potential negative externality after building them in the neighborhoods. Even if it was proven that there has been negative effect, providing possible solutions to minimize them will mollify the negative reaction toward the potential LIHTC projects. Especially, LIHTC is relatively new type of affordable housing project which is distinctive from previous public housing projects. Mitigating the fear and prejudice of public by providing tangible evidence and solutions is crucial for providing more affordable housings spatially dispersed.

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Chapter4: Characteristics of the Study Area – Austin, Texas

The study area is Austin, the capital of Texas. As the analysis focuses on this specific region, it is necessary to understand the characteristics and the background of the city which are distinctive from other cities. Following the result of the quantitative analysis in regional context can enrich the policy implications and draw some practical policy suggestions which are tailored to the study area.

For the case of Austin, it is crucial to comprehend three major factors. First, the rapid urban growth has a significant impact on the city's housing market. The city is often called "Silicone Hills" due to its drastic economic development based on the high-tech businesses and the university. The rapid development caused a huge population growth which was led to a shortage of housing and over-stimulated rental housing market. Also, the socio-economic characteristics of the city in spatial context and its urban development history imply that the income and racial segregation of Austin has very unique spatial pattern. The Interstate Highway 35, splitting down the city into east and west, has been taking a role of a socioeconomic barrier. Lastly, most LIHTC projects in Austin are concentrated in the east part of the city which has lower median household income and higher percentage of Hispanics or blacks.

GROWTH AND HOUSING AFFORDABILITY IN AUSTIN

According to estimation by the U.S. Census, the population of the City of Austin is 725,306[1] as of 2007, the fourth largest in Texas. Area household median income (AMI) in Austin was $52,030 and 30 percent of AMI was $15,276 as of 1999.[2] About 13 percent of households in Austin were making less than 30 percent of AMI of the city.[3] On average, 37 percent of households in each Census Block Group[4] are burdened with the

housing cost burden at over 30 percent of their income, while the national average is 39 percent. If we consider the affordability gap between owners and renters discussed in introduction, the housing affordability problem in Austin is more critical than average U.S. cities.

During the past two decades, Austin has become well known for the rapid technology-based economic development.[5] Due to the economic structure based on the high-technology businesses and the university (The University of Texas at Austin), the city is attracting more population. Between 1980 and 2000, total population of Austin Metropolitan Statistical Area (MSA) increased by 132.9 percent. Moreover, Austin has experienced an abrupt increase in immigration, especially the foreign migration after 1990. Total foreign-born population has increased by 580.5 percent between 1980 and 2000 and by 172 percent between 1990 and 2000.[6] The massive flow of immigrants fulfilled the rapidly-growing demand of low as well as high-skilled workers from the high-tech industries. The immigrants were mainly from Mexico, and some highly-skilled workers were from India and China.[7]

Consequently, the increase in population has been stimulating the housing market of Austin, specifically the rental housing market.[8] Rental housing market of Austin is more stimulated than national average – renter-occupied housing units are 55.2 percent of total housing units in Austin while national level is only 29.4 percent (Table 4.1). [9] Even though rental housing projects are increasing, they tend to be redevelopment projects which are replacing existing affordable housing units into higher-priced market-rate units.[10] The replacement of affordable housing units is a result of the gentrification, which is a movement from the city government to revitalize the central Austin area influenced by the *New Urbanism.* Most of the urban infill type redevelopment projects are upscale mixed-use residential units which are not affordable for the existing residents

in the neighborhood. Consequently, recent immigrants, most likely with low income, are forced to move out further away from the central area to find affordable housing options.[11] Recognizing the segregation and the difficulty in preserving affordable housings for low-income families, the City of Austin plans to pursue the geographic dispersion of affordable housings while preserving the supply of affordable housing units.[12] One of the city's efforts to preserve affordable housing options for the existing residents is the S.M.A.R.T. (Safe, Mixed-income, Accessibility, Reasonably-priced, Transit-oriented) housing policy, initiated in April, 2000. The policy gives affordable housing projects waivers from local development fees, expedited review for development permits, and priority to urban infill type developments to keep the housing affordability of central area.

Table 4.1 Number of Owner-occupied and Renter-occupied Housing Units

	Austin, TX		United States	
	Number of Units	Percentage	Number of Units	Percentage
Owner-occupied housing units	119,102	44.8	74,088,000	70.6
Renter-occupied housing units	146,547	55.2	30,814,000	29.4
Total	265,649	100	104,902,000	100

Source: *U.S. Census Sample File 1* (2000).

There are 148 affordable housing projects in Austin as of 2008. (Table 4.2) There are 58 Low-income Housing Tax Credits (LIHTC) projects in Austin as of 2008. LIHTC projects are serving residents with various income levels. Now it is the major program for providing affordable housing option for low to moderate-income households in Austin. However, 19 projects by the Housing Authority of the City of Austin (HACA) are the main affordable housing source specifically for the households with less than 30 percent

of the AIM of Austin. The City of Austin also subsidizes affordable housing projects through the Austin Housing Finance Corporation (AHFC). Founded in 1979, AHFC provides bonds to single or multifamily affordable housing projects and facilitates building affordable housings with HOME Investment Partnership Programs and Community Development Block Grant (CDBG) from HUD.

Table 4.2 Multifamily Affordable Housing Projects in Austin, TX (2008)

Projects	Developer	Number of Projects
Public Affordable Housings	The Housing Authority of the City of Austin (HACA)	19
Affordable Housings supported by the City of Austin (AHFC)	Private or Nonprofit Organizations	67
Low-Income Housing Tax Credits (LIHTC)	Private or Nonprofit organizations	58
Total		143

Source: City of Austin Neighborhood Housing and Community Development Department, Housing Authority of the City of Austin, Texas Department of Housing and Community Affairs.

DISTINCTIVE SOCIO-SPATIAL CHARACTERISTIC OF AUSTIN AND ITS HISTORY

After the middle-class flight to suburb and the deconcentration of employment in the U.S. cities between 1970 and 1980, the center of major urban areas were occupied by influx of immigrants and impoverished people.[13] In 2000, central city per capita income as percentage of suburban per capita income in a sample of 85 cities was 83 percent, having declined from 105 percent in 1960.[14] While most U.S. cities show the concentration of poverty and minority populations in central area and show the monocentric to polycentric pattern of growth, Austin has been expanding to the north and south and the economic and race segregation of the city emerged between east and west.

This unique socio-spatial characteristic is due to the racially discriminative city plan in 1928 and growth pattern of Austin after the construction of Interstate Highway 35 (IH 35) in early 1950s. City of Austin initiated a new City Plan in 1928, which designated the east side of the East Avenue (now IH 35) as "Negro District". The city offered incentives for local merchants and Black residents to move to the east side and settle there to push them out of the downtown area of Austin.[15] In 1962, East Avenue was enlarged and converted into IH 35. The highway splits the city down into east and west and connects two metropolitan areas to the north and south – Dallas-Fort Worth and San Antonio. While keeping the African- American community on the east side of IH 35, the city has grown along the highway and most of the residential development between 1950 and 1990 occurred along the north-south direction.[16] Since then, the term 'East Austin' has been widely used as 'the east side of the IH 35'. In 1990s, Austin experienced rapid growth of influx of immigrants, especially Hispanics, as a "pre-emerging gateway" of immigrants to U.S.[17] As defined by Singer, Austin used to have very low percentage of foreign-born during the entire 1900s yet showed exponential growth in number of foreign-born since 1990s.[18] They naturally settled in East Austin area, where housing is more affordable and cultural establishments by existing immigrants are sufficient.

According to the U.S. Census 2000, as shown in *figure* 4.1, there are some distinctive socio-economic characteristics between east and west part of Austin. First, race and ethnicity composition of the west Austin is very homogeneous. Several Census Block Groups in the west side contains 85 to 100 percent of non-Hispanic white population. On the other hand, race and ethnicity composition of the east Austin is more heterogeneous. None of the Census Block Groups in Austin UA are either 100 percent Hispanic or black population. Even though there are some Block Groups with more than 50 percent of black or Hispanic population, they are all mixed with some portion of other

races. Second, households with higher income are concentrated on the west part of Austin.

Block groups with the highest 40 percent (over $68,376 in 1999) are mostly on west Austin, the dark areas on the Median Household Income map in *figure* 4.1. Also, the contrast pattern of the Median Household Income map and the Percentage of Non-Hispanic white Population map are quite similar. Specifically, the census tracts with over 82 percent of the non-Hispanic white Population mostly shows top 20 percent median household income in Austin UA. The overlap of those two socioeconomic characteristics in geographic context proves that the racial and economic segregation of Austin has east-versus-west pattern. Interestingly, LIHTC projects in Austin UA are all located on the Block Groups with less than 65 percent of non-Hispanic white population except one LIHTC project.

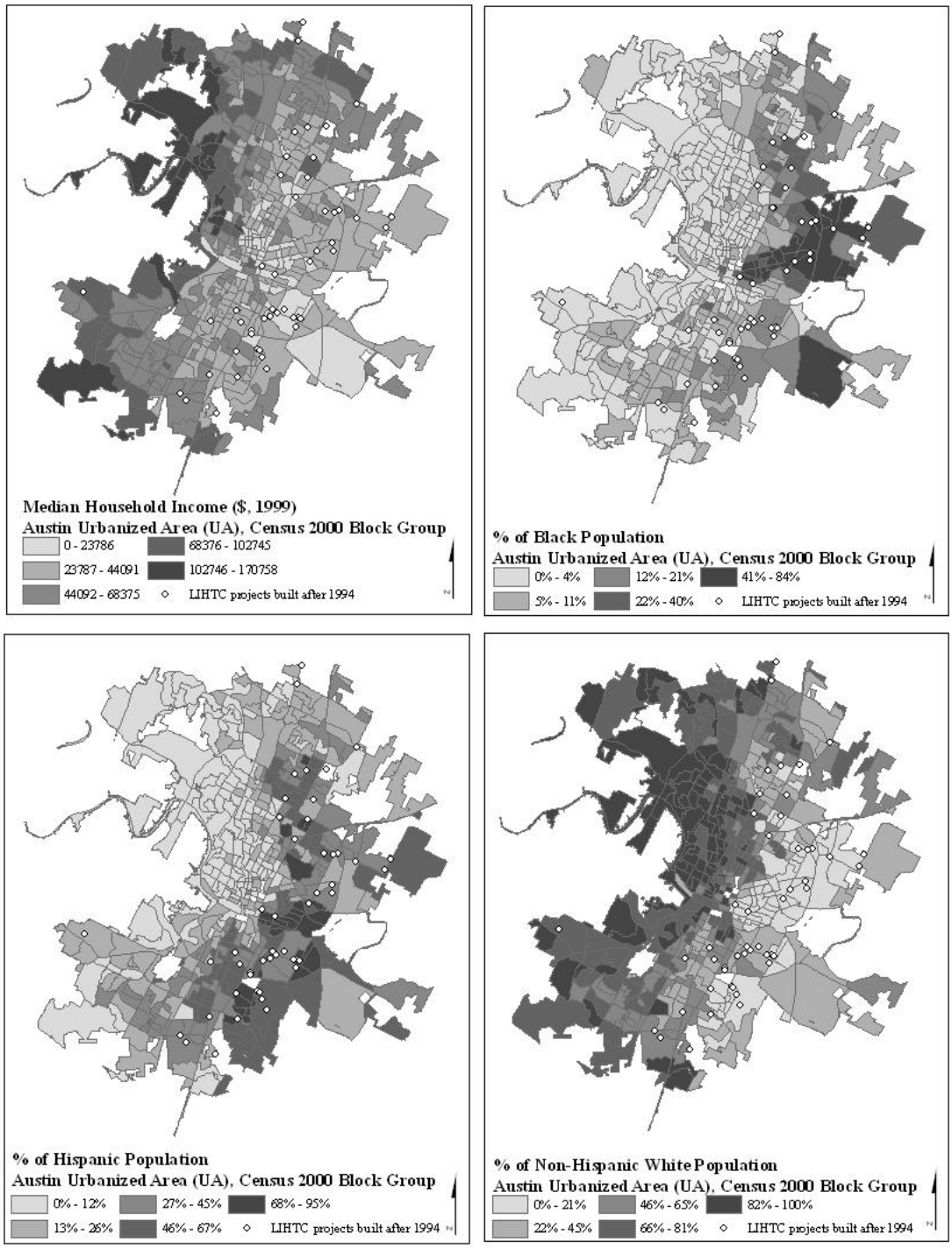

Figure 4.1 Socio-spatial Characteristics of Austin, TX

Source: *U.S. Census 2000 Block Group Sample File 3* (2000)

Note: All data are classified by natural breaks classification.

CHARACTERISTICS OF CENSUS BLOCK GROUPS WITH LIHTC PROJECTS

As described above, the location of LIHTC projects in Austin UA is not evenly distributed between east and west. Among the 48 LIHTC projects built since 1994, 35 projects are located on the east side of IH 35. There is only one project located in far west area of Austin with more than 61 percent of non-Hispanic white population. It can be explained by one of the characteristics of the LIHTC program itself which gives incentives to the projects located in Qualified Census Tracts (QCT). As of 2000, there are 46 QCTs in Austin Metropolitan Area and 37 QCTs are located in Austin UA. In *figure* 2, the crosshatched areas indicate the QCTs with LIHTC projects and throughout the Austin UA, 28 LIHTC projects are located in 18 QCTs. Among 28 LIHTC projects in QCTs, 26 projects are located on the east of IH 35. We can infer that due to the nature of the QCT, a census tract with concentration of poverty, it was inevitable to have the concentration of LIHTC project on the east part of Austin UA.

Table 4.3 Average Percentage of Races in Census Block Group, Austin TX (1999)

	Austin Urbanized Area	Block Groups with LIHTC
Non-Hispanic White	58.45%	26.23%
Hispanic	26.64%	49.18%
Black	8.60%	20.35%

Sources: *U.S. Census 2000 Block Group Sample File 3* (2000).

The concentration of LIHTC projects in QCTs and the east of IH 35 imply that there is a very large socioeconomic disparity between the neighborhoods with LIHTC projects and the entire city. We could confirm the fact on *figure* 1, showing the light-shaded areas with LIHTC projects which mean lower area median household income (AMI) among the other block groups. As of 1999, AMI of Austin UA is $52,030. On contrary, the AMI of the Block Groups with LIHTC projects is $33,920 which is 65

percent of the Austin UA. Also, the LIHTC projects are mainly located in the areas with high percentage of Hispanic and black population. As shown on Table 4.3, about 50 percent of population in block groups with LIHTC is Hispanic in average. Moreover, black population is over 20 percent while average Austin Urbanized area has 8 percent of black population per block groups.

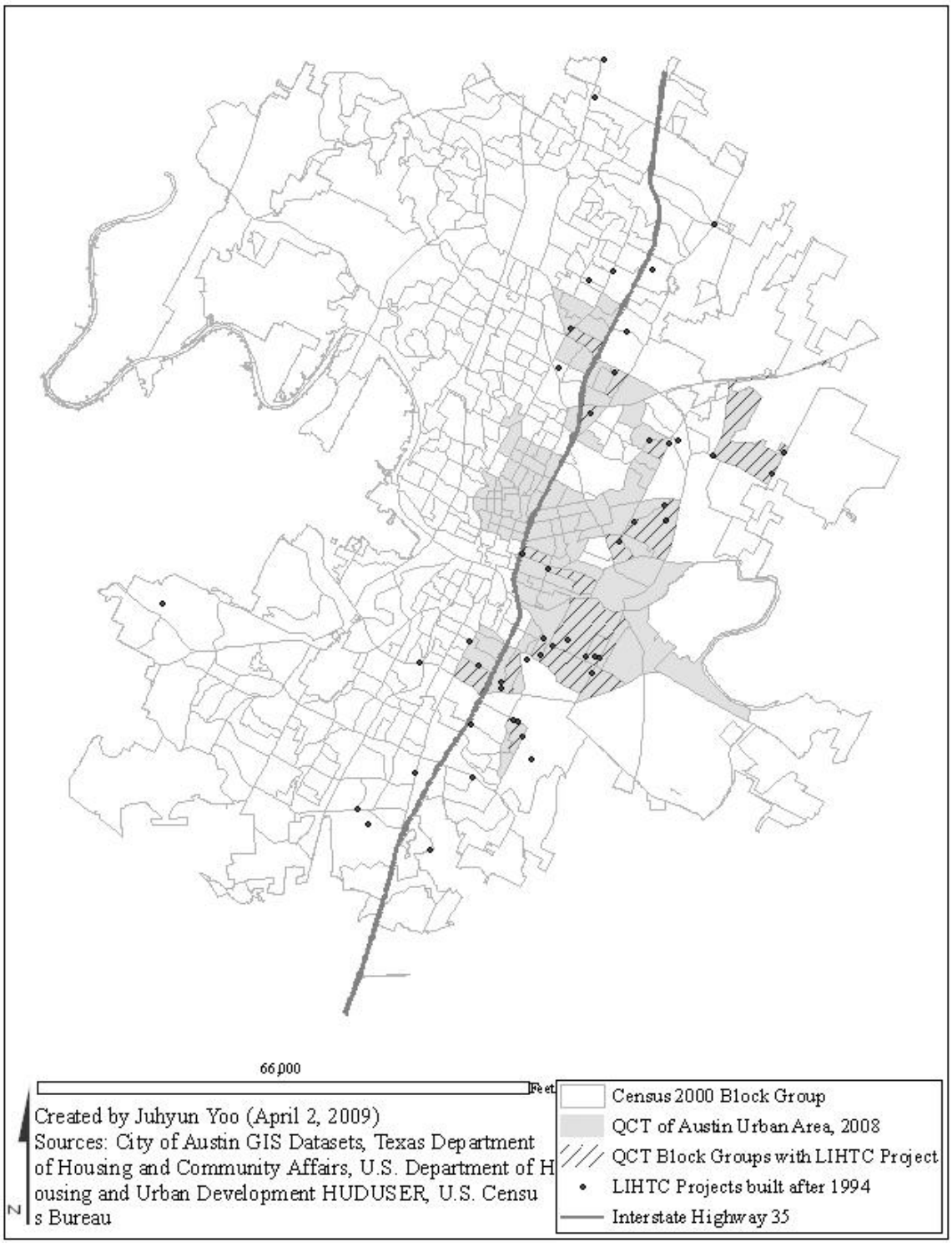

Figure 4.2 Location of LIHTC Projects and Qualified Census Tracts, Austin, TX

[1] U.S. Census Bureau, "2007 Population Estimation," http://factfinder.census.gov/servlet/GCTTable?-ds_name=PEP_2007_EST&-mt_name=PEP_2007_EST_GCTT1R_ST9S&-geo_id=04000US48&-format=ST-9&-tree_id=806&-context=gct (accessed October 11, 2008)

[2] Census 2000 survey was conducted in 1999 and the monetary values of income-related variables are recorded in dollar term of 1999.

[3] Extremely-low income level is defined as lower or equivalent to 30 percent of the average median family income (AMFI) in the area by the HUD.

[4] Census 2000 Block Group is 'a cluster of census blocks having the same first digit of their four-digit identifying numbers within a census tract' according to the definition by U.S. Census Bureau. (Census Block Groups Cartographic Boundary Files Descriptions and Metadata, http://www.census.gov/geo/www/cob/bg_metadata.html, accessed in March, 2009)

[5] Emily Skop, "Fueling Austin's Boom: The New 21st Century Immigrant Metropolis," in *Twenty-First Century Gateways: Immigration Incorporation in Suburbia*, ed. Audrey Singer, Susan Hardwick and Caroline Brettell (Washington D.C.: Brookings Institution, 2003)

[6] Audrey Singer, "The Rise of New Immigrant Gateways," *The Living Cities Census Series* (Washington, DC: Center on Urban and Metropolitan Policy, the Brookings Institution, 2004) 21.

[7] Emily Skop, "Fueling Austin's Boom: The New 21st Century Immigrant Metropolis," in *Twenty-First Century Gateways: Immigration Incorporation in Suburbia*, ed. Audrey Singer, Susan Hardwick and Caroline Brettell (Washington D.C.: Brookings Institution, 2003): 261.

[8] The City of Austin Purchasing Office, "Comprehensive Housing Market Study: Scope of Work," City of Austin, 2007: 2.

[9] U.S. Census, "Census 2000 Sample File 1," http://factfinder.census.gov/servlet/QTTable?_bm=y&-geo_id=16000US4805000&-qr_name=DEC_2000_SF1_U_QTH2&-ds_name=DEC_2000_SF1_U. (accessed October 13, 2008)

[10] The City of Austin Purchasing Office, "Comprehensive Housing Market Study: Scope of Work." City of Austin, 2007: 2.

[11] Emily Skop, "Fueling Austin's Boom: The New 21st Century Immigrant Metropolis," in *Twenty-First Century Gateways: Immigration Incorporation in Suburbia*, ed. Audrey Singer, Susan Hardwick and Caroline Brettell (Washington D.C.: Brookings Institution, 2003): 270.

[12] The Affordable Housing Incentives Task Force, "The Affordable Housing Incentives Task Force Report," working paper, The City of Austin, February 20, 2007: 20.

[13] Paul A. Jargowsky, *Poverty and Place: Ghettos, Barrios and the American City* (New York: Russell Sage Foundation, 1997), 29.

[14] Peter Dreier, John Mollenkopf and Todd Swanstrom, *Place Matters: Metropolitics for the Twenty-first Century*, 2nd rev. ed. (Lawrence: University Press of Kansas, 2004), 46, figure 2-1.

[15] City of Austin, "Handbook of Texas Online: Austin, TX; images from the original City Plan (1928)" http://www.ci.austin.tx.us/carver/downloads/cityplanpage.pdf (accessed March 29, 2009)

[16] Nathaniel Baum-Snow, "Did Highway Cause Suburbanization?" *The Quarterly Journal of Economics* 122, no. 2 (May 2007): 787.

[17] Audrey Singer, "The Rise of New Immigrant Gateways," *The Living Cities Census Series* (Washington, DC: Center on Urban and Metropolitan Policy, the Brookings Institution, 2004), 9.

[18] Ibid., 5.

Chapter5: Research Method to Measure the Impact of LIHTC Projects

Given that one of the purposes of LIHTC is to facilitate the 'social mix' within the projects and throughout the neighborhoods where the LIHTC projects are located, it is crucial to draw the consent of immediate neighbors to locate the projects not only for the approval for physical development but also for the social integration into the community. However, as discussed in previous chapter, LIHTC projects usually face major backlash by neighborhoods due to their negative perception toward affordable housing projects in general and fear toward the possibility of decrease in their property value.

In this context, this chapter presents the empirical model to measure the impact of LIHTC projects in neighborhood single-family home property value. The main hypothesis is that the LIHTC projects have negative impact in neighborhood single-family housing property value. The hypothesis will be tested using hedonic price model which reflects the factors determining the property value of each single-family home near LIHTC projects. As the impact of LIHTC projects cannot be explained by the single factor of themselves, four detailed hypotheses are established based on the sizes of the projects, distances from the single-home properties, population served by the projects and pre- or post- construction of the projects.

HYPOTHESES AND PREVIOUS STUDIES

Main Hypothesis

This study tests the main hypothesis that LIHTC projects have negative impact on neighborhood single-family homes property values in Austin, Texas. The result of previous studies on the impact of affordable housing projects varies among the

methodologies and the study area. Nguyen (2005) found that out of 17 previous studies on similar topic, 6 studies concluded that affordable housing projects had negative impacts while 13 studies said the impacts are positive and one study showed two different results depending on the kind of affordable housing projects. However, it is not easy to make an assumption on the relationship between the affordable housing projects and the surrounding single-family property value based on previous studies as each study is conducted in different area and their sample sizes varies. Nevertheless, this study assumes that LIHTC projects have negative impact on neighborhood property value in Austin, Texas as there have been numerous incidents showing the NIMBYism toward the projects.[1]

Specific Hypotheses

As the impact of LIHTC projects on single-family home property value can be affected by numerous factors, this study is designed to ask several specific questions that will capture the complexity of the impact of LIHTC projects. Single-family home property value near LIHTC projects can be affected by distance from the LIHTC project, size of the projects, population served by the projects and pre- or post- LIHTC project construction.

Distance from the nearest LIHTC projects and its impact on property values

Does the effect of LIHTC properties in single-family homes property value vary along the distance within a 2000-foot radius? The 2000-feet distance range was determined based on the previous studies by Galster et al (2004) and Galster et al (1999).[2] Two studies based on the property value data of Denver, Colorado and Baltimore County, Maryland calculated spatial lag to measure how far the impact on property value can reach from the LIHTC properties and both studies adopted 2000-feet distance range

regardless the study area. Even though this study did not calculate the exact spatial lag, the same 2000-feet distance range was selected as it was assumed that urban areas usually have similar spatial lag in single-family home property value as the two areas in existing studies.

Within a 2000-foot radius from LIHTC projects, it is expected that the property value of single-family homes will decrease. Moreover, the properties located closer to the LIHTC projects might be more likely to experience larger decrease in property value. For example, Lee et al (1999) found out that impact of public housings on neighborhood property value decreases by distance in their case study in Philadelphia.[3] Galster et al (1998) also discussed that the area with concentration of Section 8 units affected negatively on neighborhood property sales price and the impact was largest within a 500-foot radius from LIHTC projects in Baltimore County.[4]

Differential impact of the size and the percentage of affordable units of the LIHTC projects

Does the size of the LIHTC project or the percentage of below market-rate units have any differential impact on the neighborhood single-family homes property values? As discussed in chapter 3, it has been a common impression that multifamily housing developments, especially affordable housing projects, have negative impact in neighborhoods. It is due to abrupt expansion in population within the neighborhood which requires more public services such as water, sewage, transportation or schools. Residents think that higher demand for public services will increase their tax burden. Recent studies insist that there is no empirical evidence to prove the negative impact of multifamily housing itself on neighborhood property value to promote the higher-density development for efficiency and sustainable urban growth. Haughey (2005) supported this idea by suggesting five misunderstandings toward multifamily housings including their

negative impact on property value of adjacent housings.[5] However, positive impacts are very limited cases of upscale market-rated multifamily housings and more studies for below-market housings are needed.

Also, the proportion of below-market unit in LIHTC project means the 'income mix' within the projects. LIHTC program allows developers to designate some portion of the project as market-rated units to compensate the possible profit loss from having below-market rent projects and it creates the unique social mix within the projects. Measuring the impact of the income mix within projects will show how it affects the neighborhood property value changes.

Served population and the negative impact of LIHTC projects

Does the difference in population served (low-income families versus elderly population) of LIHTC properties affect adjacent the single-family homes property values? Some LIHTC projects serve seniors only while others are serving general low- to moderate-income families. In general, supportive housings or affordable housings for seniors are studied separately as they have different characteristics. Some studies suggest that housings for seniors do not have negative impact as much as other types of supportive or affordable housings. Freeman and Botein (2002) argued that elderly residents of supportive housings are considered 'deserving poor', who do not have significant impact on neighborhood property values.[6] Therefore, it is reasonable to try to measure the differential impact of two different groups of population served by LIHTC projects.

Pre- and post- LIHTC project construction

Does the effect of LIHTC properties change over time? Is there a difference in impact between pre- and post-LIHTC project constructions? This question will explain

whether the impact of LIHTC projects is stronger before or after the construction. LIHTC projects in Austin usually obtain the tax credit and get approval for construction from the City of Austin. The tax credit and construction approval usually occurs 1-2 years before the actual opening date of the projects which is the period when the neighborhoods of potential projects uproar and express their opposition to the new projects. After the construction of the actual project, the projects can either improve the condition of neighborhoods or keep decreasing the property value of the neighborhoods. With this various possibilities, testing the differential impact of LIHTC projects before and after the project construction will answer the question properly.

SCOPE OF ANALYSIS AND DEFINITIONS

To test the hypothesis and answer the detailed questions, multivariable regression analysis was performed using hedonic price model. The unit of analysis for this model is the each single-family home within a 2000-foot radius from LIHTC projects. In this model, we regress the natural log of the appraised value of single-family home property value on three different groups of predictor variables – characteristics of the nearest LIHTC project from the property, characteristics of the property itself and the socioeconomic characteristics of its neighborhood. The variables include the physical attributes of the properties, distance from the LIHTC projects, socioeconomic characteristics of the neighborhood by census block group and the characteristics of the LIHTC projects.

This study focuses on the Urban Area (UA) of Austin, Texas by the U.S. Census 2000 definition. According to the Census Bureau, UA consists of 'core census block groups or blocks that have a population density of at least 1,000 people per square mile and surrounding census blocks that have an overall density of at least 500 people per

square mile'.[7] Target LIHTC projects for the analysis are defined as 'LIHTC projects built between 1995 and 2006 located within the UA boundary.' The majority of Austin UA overlaps with Travis County and partially with Hays County and Williamson County. However, Hays and Williamson County part of Austin UA are excluded from this study.

The neighborhood of an LIHTC project refers to the surrounding area within 2000 feet radius from that LIHTC project. Single-family homes are the residential properties with one or two establishments on the parcel. Establishments on a parcel refer to any kind of 'physical buildings' built on the parcel. Single-family homes property value means the appraised property value by the parcel unit (which includes both land and establishments) for the tax roll estimated by the Travis Central Appraisal District (TCAD) annually. The unit of analysis is 'parcel' defined by TCAD and their Property ID indicating each parcel was used as a primary key to explain relationships between all datasets.

VARIABLE OPERATIONALIZATION

The simplified conceptual model indicated below explains the values of a single-family home *i* within year *t* with the characteristics of the nearest LIHTC from the property (L_{it}), characteristics of the property itself (P_{it}) and the socio-economic characteristics of the Census Block Group in which the property is located (N_{it}). Each category of variables are shown in Table 5.1 and described below.

$$PV_{it} = f[(L_{it}), (P_{it}), (N_{it})]$$

Property value (PV_{it}), the dependent variable is the annual appraised value of the individual property i at year t. To reflect the change of inflation over time, S&P/Case and Schiller U.S. National Home Price Index was introduced to adjust the property value to real dollar terms with the first quarter of 2000 as the base period.[8] Only the index of the

first quarter of each year was adopted as our property value dataset is based on annual appraisals. Each appraised value was multiplied by the index of the corresponding year.

Characteristics of the nearest LIHTC projects

Independent variables describing the characteristics of the nearest LIHTC projects are included in the regression model (L_{it}). Percentage of affordable units to the total units, served population of LIHTC units, total number of units and the percentage of disabled units are the variables characterizing the LIHTC projects. It is expected that the LIHTC projects serving elderly population has different effect from those serving general low-income population as elderly occupants are usually recognized as 'deserving poor' who are different from the low-income individuals who gave up upward mobility in the society and have pathological behaviors to harm the stability of their neighborhood.[9]

Characteristics of the Single-Family Properties

Characteristics of the single-family properties (P_{it}) are reflected as a series of independent variables – physical characteristics, distance from the nearest LIHTC projects, distance from the central business district (CBD) and the year of the appraisal. Four dummy variables (Ayr1, Ayr2, Ay3, Ayr4) indicating whether the appraised property value is pre- or post- construction of LIHTC projects will show the change of the single-family homes property value by the stage of the development of LIHTC projects. One category (two years after construction of LIHTC) is excluded in constructing variables to avoid dummy variable trap. Distance from CBD is important in determining property values as it is a general assumption that property value increases as the properties are located closer to the CBD, which is a cluster of employment and economic activities of the city. Distance from LIHTC projects are classified into four different mutually-exclusive regions and converted into three dummy variables (Dist500,

Dist1000, Dist1500). The model assumed that there is no differential effect of the number of LIHTC projects within the neighborhood, therefore the variable indicating the number of projects within certain distance is excluded from the model. Given there are four distance rings, only three dummy variables are created for estimating the impact of distance from LIHTC projects to avoid dummy variable trap.

Socio-economic Characteristics of the Neighborhood

Socioeconomic characteristics of the neighborhood based on the U.S. Census 2000 Block Group are reflected in five variables –percentage of non-Hispanic white population, percentage of black population, percentage of Hispanic population and average household median income. (N_{it}) Racial composition variables are under the assumption that the white population will show distinguishing impact depending on whether the population is Hispanic or not. However, as the proportion of the black Hispanic population is insignificant in Austin UA, no distinction between Hispanic and non-Hispanic black is incorporated in adopting variables.

Table 5.1 Variables and Definitions

Category	Name	Definition
PV	PV_t	Appraised value of the property in year t
L	**Characteristics of the nearest LIHTC project**	
	Lunit	Percentage of LIHTC units
	Tunit	Number of Total units
	Dunit	Percentage of Disabled units
	Eld	Served Population (if elderly=1, otherwise =0)
P	**Characteristics of the Single-Family Properties**	
	Ayr1	=1 if appraised year is 2 year before the built year of LIHTC, otherwise =0
	Ayr2	=1 if appraised year is 1 year before the built year of LIHTC, otherwise =0
	Ayr3	=1 if appraised year is the built year of LIHTC, otherwise =0
	Ayr4	=1 if appraised year is 1 year after the built year of LIHTC, otherwise =0
	Area	Size of the Property (square feet)
	Dist500	=1 if the property is within 500 feet radius from the nearest LIHTC, otherwise=0
	Dist1000	=1 if the property is within 1000 feet radius from the nearest LIHTC, otherwise=0
	Dist1500	=1 if the property is within 1500 feet radius from the nearest LIHTC, otherwise=0
	numGarage	Number of garages in the property
	numFireplace	Number of fireplaces in the property
	numBath	Number of bathrooms in the property
	Age	Age of the establishments
	DCBD	Distance from 6th and Congress to the centroid of the parcels (US ft)
	D_i	Nearest LIHTC project (i =1,2,3…36)
N	**Socio-economic Characteristics of the Neighborhood**	
	AMI	Average Household Median Income
	Hisp	% of Hispanic population
	Black	% of non-Hispanic black population

Notes: t (year the property was appraised) can vary from 1993 to 2008.

DATASETS

Datasets for the analysis can be categorized into two groups – statistical data and geospatial data. Statistical data includes the datasets indicating socio-economic characteristics of the neighborhoods of LIHTC projects, inventory of LIHTC projects, property value of single-family homes and their physical conditions. Geospatial data includes the map of the U.S. Census Block Group in 2000 and the map of the TCAD parcel. Geospatial datasets contain the unique identification numbers to project the statistical information on the map. Throughout the dataset preparation process, Property ID designated by TCAD is used as a primary key to merge statistical and geospatial datasets.

Preparing Statistical Datasets

To analyze the change in property value of single-family homes adjacent to LIHTC projects, the dataset of annual appraised value of residential properties is selected. The Travis Central Appraisal District (TCAD) has been keeping the record of appraised value of the entire properties within Travis County since 1993. The dataset contains not only the property value but also the history of home improvement, physical condition and the change of ownership. Among the entire residential property inventory, properties with more than two establishments are filtered out to exclude multifamily type housings from this study.

LIHTC projects inventory data is obtained from the Texas Department Housing and Community Affairs (TDHCA).[10] The data is open to the public. Since 1991, 56 projects have been approved by TDHCA and built by various developers. As the analysis aims to measure the impact of LIHTC projects two years before and after the construction of them, the projects built before 1995 and after 2006 have to be excluded to comply with

the time frame of available appraised property value of single-family homes. The 43 projects built in between 1996 and 2006 are geocoded to map the locations and neighborhoods using geographic information system (GIS) package, ArcGIS. ArcCatalog Address Locator is created based on U.S. streets and Geocoding function in ArcMap is utilized to locate the address data from TDHCA on the exact location. While approximately 85 percent of the LIHTC properties (40 properties) matched by their street number and street names, three properties cannot be geocoded due to the incorrect or unavailable address on the original dataset from TDHCA. The extracted dataset includes the built year, number of LIHTC units, number of units for disabled, total units and the serving population of each project- elderly or general.

Dataset of socio-economic characteristics of the neighborhoods with LIHTC projects is obtained from the U.S. Census decennial survey Summary File 3 (SF3) of 2000. All census datasets are Block Group level in UA of Austin determined by the Census 2000. Block Groups are delineated by local governments which are under the Participant Statistical Area Program by the U.S. Census Bureau. One Block Group contains 600 to 3000 people and 1500 per Block Group is considered ideal.[11] The dataset provides average median household income and percentage of each racial or ethnic group –Hispanics, Blacks, Asians, and non-Hispanic Whites.

Merging the Statistical and Geospatial Datasets

On the map of LIHTC projects, four mutually-exclusive buffer rings are created around the projects – 500-foot, 501 to 1000-foot, 1001 to 1500-foot and 1501 to 2000-foot radius from each LIHTC project. Among the TCAD parcels which are in the boundary of our analysis, only parcels within 2000-feet radius from selected LIHTC projects are selected for the analysis. The number of parcels in our analysis varies

depending on the appraisal year and the built year of the nearest LIHTC projects from the parcel. The appraised property values of each parcel within the five-year time frame (two years before and after the construction of the nearest LIHTC project) are adopted. In addition, the dataset indicating physical characteristics of the establishments are added to the dataset. It includes year in which establishments are built, number of bathrooms, number of garages and number of fireplace and size of the parcel. In case of multiple establishments existing in one parcel, the oldest year is selected to measure the age of establishment as it is assumed that most people build the main house first before building additional establishments.

A dataset indicating the distance from Central Business District (CBD) to each parcel is calculated. CBD of Austin is defined as intersection of 6th Street and Congress Avenue as the block has been the center of business historically. The point is created as a feature and the distance between the CBD point and the centroid of the each parcel is calculated to measure the distance between the parcels and CBD.

Issues with Datasets

There are some caveats related to the datasets which can possibly affect the result of analysis. First, some datasets have their own limitations. Appraised property values are not based on the actual housing sale price. Usually, actual housing sale price is higher than appraised values as sellers tend to add property tax and some other subjective values on top of the appraised value of the property. Furthermore, appraisal itself is based on its own explanatory variables determined by TCAD. Control over the effect of those variables is limited as it is impossible to include all variables from the actual appraisal to this analysis. Also, the U.S. Census is decennial survey which does not represent the recent demographic and socio-economic changes in the area within 10 years. The most

recent data available as of 2009 is the U.S. Census 2000, surveyed in 1999 while the property value data starts from 1993. Moreover, the dataset based on the Block Group do not correspond with our own definition of neighborhoods. Thus, the Census data can only provide proximate socio-economic and demographic information of the study neighborhoods. Lastly, it was impossible to find socioeconomic information of LIHTC tenants. The data can be helpful to measure the externalities of LIHTC projects in their neighborhood property value based on the income level of tenants in LIHTC affordable units. According to previous attempts for similar research[12], there is no organization or official entity keeping the track of data reflecting the income level of LIHTC tenants and its changes.

Processing data to fit into the analysis also have some issues. Geocoding procedure for locating LIHTC projects is not 100 percent accurate. It is relatively precise; however, three projects are excluded due to the technical difficulty in geocoding based on their addresses listed in the LIHTC inventory provided by TDHCA. In addition, the geocoding process is based on U.S. Streets and Numbers, which means that the LIHTC properties are recognized as points, not as polygons showing the actual size of the properties. It made difference in calculating distances from LIHTC projects to surrounding parcels and the actual distance between those can be different from the estimation for this study.

EMPIRICAL MODELING

This study establishes two Log-Lin models based on Hedonic Pricing method. The hedonic pricing model method determines the property value based on all factors which can affect the property value. The initial model is designed to include all independent variables to see the differential impact of each variable – characteristics of

the nearest LIHTC projects, socioeconomic characteristics of the neighborhood, and the characteristics of the single-family property itself. The second model incorporates six more variables in addition to the variables from the first model – interactive terms between the appraised year and distance from LIHTC projects. The second model allows to test the sensitivity of the first model and to distinguish the impact of distance from LIHTC on property value depending on the pre- and post- LIHTC construction.

Hedonic Price Model

Hedonic prices are defined as "the implicit prices of attributes and are revealed to economic agents from observed prices of differentiated products and the specific amounts of characteristics associated with them."[13] In this analysis, hedonic price model assumes that the property value is determined by the multiple characteristics of the property. Home buyers value various factors of the property including physical characteristics and socioeconomic conditions of the neighborhood. Hedonic price model in this analysis uses a multiple regression model which includes all possible factors determining the property value. In this study, all policy variables related to the possible NIMBYism toward LIHTC projects are incorporated as hedonic factors. The policy variables are the physical conditions of the property, location, neighborhood demographics and economic conditions and the characteristics of the closest LIHTC project from each property. By including all three factors as explanatory variables, the model can delineate the pure effect of LIHTC projects on the property values while controlling other relevant factors. The result of the regression will capture the differential impact of LIHTC projects on neighborhood single-family homes in monetary value.[14] Moreover, stratifying the data by neighborhood characteristics or physical attributes of the LIHTC projects are crucial for elaborating the differential impacts throughout the neighborhoods or the different

characteristics of LIHTC projects.[15] The result can demonstrate the differential effects as long as they are included in the model as explanatory variables.

This model can be distinguished from "Test versus Control Area Methodology"[16] which compares the change in property value of two similar neighborhoods, one with LIHTC project and the other without LIHTC project. While Control Area model requires finding a neighborhood with comparable characteristics with the test neighborhood, which is a major difficulty in the methodology, hedonic price model does not need the controlled neighborhood. It minimizes the possibility of excluding the differences or hidden impacts of the neighborhood property values in comparing the two areas.

Model Specification

Two models were built to estimate natural log of inflation-adjusted property value of the single-family properties. The empirical model estimating the linear relationship between natural log of dependent variable and the dependent variables are often called Log-Lin model. This model is used when dependent variable is not normally distributed and rather skewed such as income distribution or property value distribution. By taking natural log of the property value data, it can become closer to normal distribution which will prevent misleading regression analysis results.

$$LnPV_t = C + a_1\,[Lunit] + a_2\,[Dunit] + a_3\,[Tunit] + a_4\,[Eld] + a_5\,[age_t] + a_6\,[Area_t] + a_7\,[Dist500] + a_8\,[Dist1000] + a_9\,[Dist1500] + a_{10}\,[numBath_t] + a_{11}\,[numGarage_t] + a_{12}\,[numFire_t] + a_{13}\,[D_i] + a_{14}\,[DCBD] + a_{15}\,[Ayr1_t] + a_{16}\,[Ayr2_t] + a_{17}\,[Ayr3_t] + a_{18}\,[Ayr4_t] + a_{19}\,[AMI] + a_{20}\,[Hisp] + a_{21}\,[Black] + \varepsilon_t$$

Where t = 1993, 1994…, 2008 and i =1, 2, 3…,36
C = constant
ε_t = stochastic error
a_1 , a_2, a_3,…a_{21} = coefficient

Figure 5.1 Model 1

Model 1 explains the dependent variable with all independent variables indicating the characteristics of the single-family property, its neighborhood and the nearest LIHTC project. The first model can explain how the distance from LIHTC or the year of appraisal changes the property value of single-family homes; however, it cannot delineate the impact of LIHTC projects within distant ranges before and after the construction of the project.

$$LnPV_t = C + a_1\,[Lunit] + a_2\,[Dunit] + a_3\,[Tunit] + a_4\,[Eld] + a_5\,[age_t] + a_6\,[Area_t] + a_7\,[Dist500] + a_8\,[Dist1000] + a_9\,[Dist1500] + a_{10}\,[numBath_t] + a_{11}\,[numGarage_t] + a_{12}\,[numFire_t] + a_{13}\,[D_i] + a_{14}\,[DCBD] + a_{15}\,[Ayr1_t] + a_{16}\,[Ayr2_t] + a_{17}\,[Ayr3_t] + a_{18}\,[Ayr4_t] + a_{19}\,[AMI] + a_{20}\,[Hisp] + a_{21}\,[Black] + a_{22}\,[Ayr1*Dist500] + a_{23}\,[Ayr1*Dist1000] + a_{24}\,[Ayr1*Dist1500] + a_{25}\,[Ayr4*Dist500] + a_{26}\,[Ayr4*Dist1000] + a_{27}\,[Ayr4*Dist1500] + \varepsilon_t$$

Where t = 1993, 1994…, 2008 and i =1, 2, 3…,36
C = constant
ε_t = stochastic error
a_1 , a_2, a_3,…a_{27} = coefficient

Figure 5.2 Model 2

Model 2 is designed to measure the change in property value of pre- and post-LIHTC project construction within three different distance rings. Two years prior and a year after the construction of the nearest LIHTC project were selected to compare the sensitivity of the differential impact of the distance from the LIHTC projects. Interactive terms between the two appraised year variables (Ayr1, Ayr4) and the distance variables (Dist500, Dist1000, Dist1500) were added to the first model. The second model serves not only as a model to show the differential impact but also as a sensitivity analysis for the first model. By adding few more variables to the first model, the robustness of the model can be measured.

[1] NIMBYism toward LIHTC projects in Austin is discussed more in chapter 3.

[2] George C. Galster, Peter Tatian and Robin Smith, "The Impact of Neighbors Who Use Section 8 Certificates on Property Values," *Housing Policy Debate* 10, no.4 (1998): 886; George C. Galster, Peter Tatian and Kathryn Pettit, "Supportive Housing and Neighborhood Property Value Externalities," *Land Economics* 80, no.1 (2004): 44.

[3] Chang-Moo Lee, Dennis P. Culhane and Susan M. Watcher, "The Differential Impact of Federally Assisted Housing Programs on Nearby Property Values: A Philadelphia Case Study," *Housing Policy Debate* 10, no.2 (1999): 86.

[4] George C. Galster, Peter Tatian and Robin Smith, "The Impact of Neighbors Who Use Section 8 Certificates on Property Values," *Housing Policy Debate* 10, no.4 (1998): 912.

[5] Richard M Haughey, *Higher-Density Development: Myth and Fact,* (Washington, D.C.: Urban Land Institute, 2005): 13.

[6] Freeman and Botein, "Subsidized Housing and Neighborhood Impacts: A Theoretical Discussion and Review of the Evidence," *Journal of Planning Literature* 16, no 4, 2002: 362.

[7] U.S. Census Bureau, "Census 2000 Urban and Rural Classification," Urban and Rural Classification, http://www.census.gov/geo/www/ua/ua_2k.html (accessed February 10, 2008)

[8] S&P/ Case & Schiller U.S. National Housing Price Index are calculated quarterly based on single-family home prices of the nine U.S. Census divisions.

[9] Lance Freeman and William Rohe, "Subsidized Housing and Neighborhood Racial Transition: An Empirical Investigation," *Housing Policy Debate* 11, no.1 (2000): 80

[10] Texas Department of Housing and Community Affairs, "2008 Property Inventory – as of November 13, 2008 Board Meeting," http://www.tdhca.state.tx.us/multifamily/htc/docs/08-PropertyInventory.xls (accessed December 21, 2008)

[11] U.S. Census Bureau, "Census Block Groups Cartographic Boundary Files Descriptions and Metadata," Geographical Area Description, http://www.census.gov/geo/www/cob/bg_metadata.html (accessed March 23, 2009)

[12] Lance Freeman, "Siting Affordable Housing: Location and Neighborhood Trends of Low Income Housing Tax Credit Developments in the 1990s," *Census 2000 Survey Series* (March 2004): 11.

[13]Sherwin Rosen, "Hedonic Prices and Implicit Markets: Product Differentiation in Pure Competition," *The Journal of Political Economy* 82, no.1 (1974): 35.

[14] Mai Thi Nguyen, "Does Affordable Housing Detrimentally Affect Property Values? A Review of the Literature," *Journal of Planning Literature* 20 (2005): 18-19.

[15] Lance Freeman and Hilary Botein, "Subsidized Housing and Neighborhood Impacts: A Theoretical Discussion and Review of the Evidence," *Journal of Planning Literature* 16, no.4 (2002): 371-372

[16] Mai Thi Nguyen, "Does Affordable Housing Detrimentally Affect Property Values? A Review of the Literature," *Journal of Planning Literature* 20 (2005): 17.

Chapter6: Quantitative Impact of LIHTC Projects on Property Value

In chapter 5, two models were designed to estimate the impact of LIHTC projects on single-family home property values in Austin, Texas between 1993 and 2008. In this chapter, we measure the quantitative impact of the projects based on the two models and descriptive statistics indicating distinctive dynamics and changes of the single-family property value and LIHTC projects.

The result of the empirical analysis suggests that the LIHTC projects changed the trend of the single-family home property value negatively, especially one or two years before the construction of LIHTC projects. In addition, there are several characteristics of LIHTC projects which have detrimental impact on neighborhood property value. For example, LIHTC projects serving population decreases the neighborhood property value more than those serving general population. Also, bigger LIHTC projects have more negative impact on neighborhood property values. The analysis on the variables related to the policy variables suggests us valuable policy implication for development of LIHTC projects.

DESCRIPTIVE STATISTICS

Throughout the study period, between 1995 and 2006, 37 LIHTC projects were built in Austin Urban Area (Table 6.1). About 93 percent of the units built by LIHTC are below market-rent units. Given the percentage is far beyond the minimum percentage of below market-rate units required for LIHTC developments, it suggests an interesting view point in interpreting the result of the regression analysis. Especially, the estimated coefficient of variable indicating the number of below market-rate units within the nearest LIHTC projects (Lunit) will test whether this high percentage of low-income units are beneficial in implementing LIHTC program.

Table 6.1 Summary Statistics of LIHTC Projects (1995-2006)

Built Year	Built Projects	Total Units	LIHTC Units	LIHTC Units (%)
1995	2	228	228	100.00
1996	2	320	243	75.94
1997	1	96	96	100.00
1998	2	356	265	74.44
1999	3	600	543	90.50
2000	7	1140	1070	93.86
2001	5	947	927	97.89
2002	5	1083	1050	96.95
2003	3	664	578	87.05
2004	2	195	171	87.69
2005	2	318	316	99.37
2006	3	314	314	100.00
Total	37	6261	5801	92.65

Source: Texas Department of Housing and Community Affairs

The most vibrant construction of LIHTC projects happened in between 2000 and 2002 - more than half of the LIHTC units were built in the period (Figure 6.1).

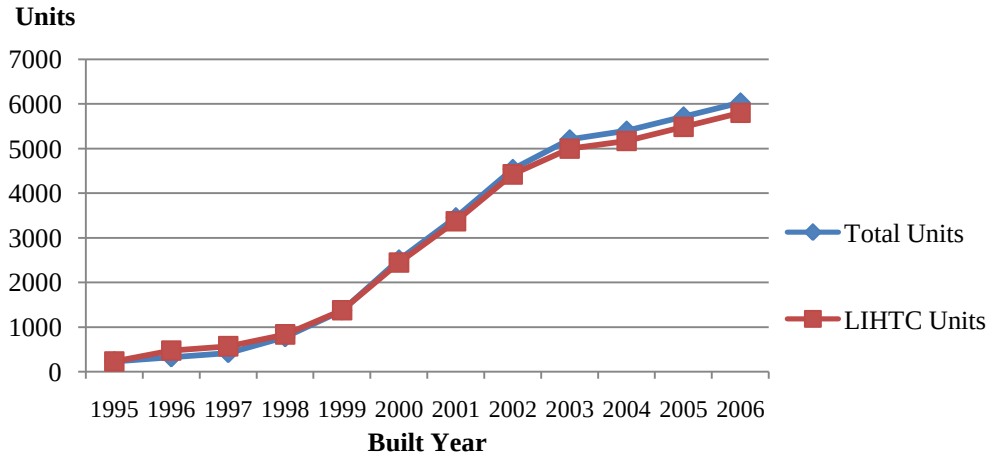

Figure 6.1 LIHTC Project Constructions by Construction Year, Austin, TX

Source: Texas Department of Housing and Community Affairs

LIHTC projects had become more dispersed over time as shown in *figure* 6.2. Among 17 projects built in between 2000 and 2002, 5 projects were located on the west

side of IH 35. Interestingly, the only LIHTC project in the west side of MOPAC EXPY was built in this period. As of 2006, there are 10 LIHTC projects in the west part of Austin. Even though it is only about 28 percent of the entire number of LIHTC projects, it still can be interpreted as a positive change in terms of geographical balancing of affordable housing options. However, more effort is necessary to disperse the construction of LIHTC projects, specifically in central and north central Austin.

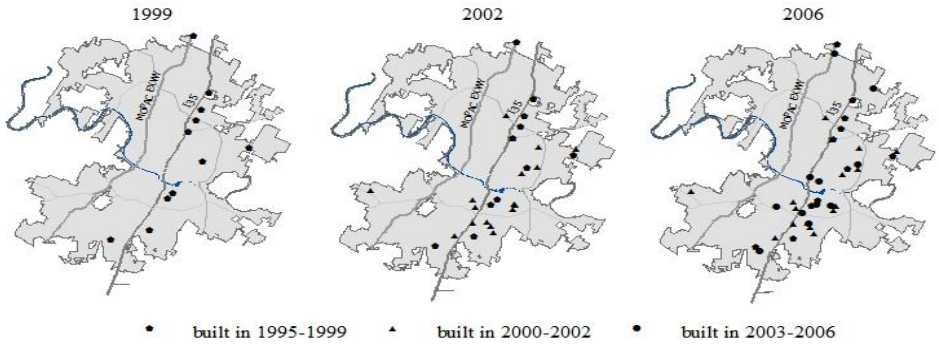

Figure 6.2 Geographic Distribution of LIHTC Projects

Property value of neighborhood single-family homes was the lowest in the closest distance ring – within a 500-foot radius from LIHTC projects. It was the same for both before and after the construction of LIHTC projects. Property values of two years before (Ayr1) and one year after the LIHTC project construction (Ayr4) were compared and showed that there is relatively big property value gap between within a 500-foot radius and within 501 to 2000-foot radius. Also, the property value gap between distance ranges became larger after the construction of LIHTC projects. (Figure 6.3)

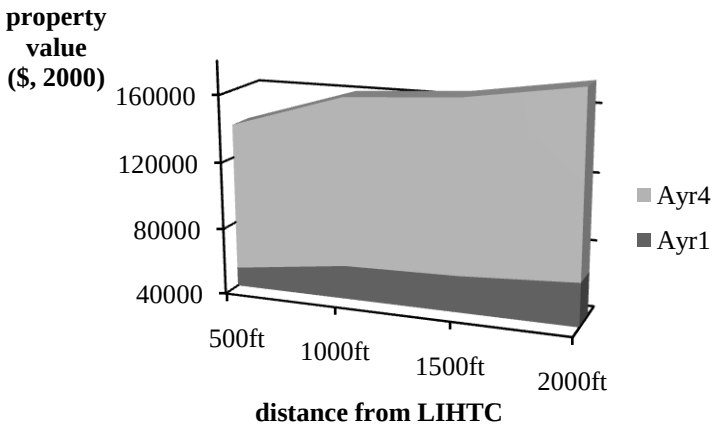

Figure 6.3 Property Value Change, Pre- and Post- LIHTC Construction

POWER OF THE MODELS

The empirical models were designed based on the hedonic price model which incorporates all possible factors which can affect the single-family home property value. Each property value is adjusted to the dollar term with the first quarter of 2000 as the base period using the Case/Schiller S&P U.S. National Home Price Index. The outcome variable is the natural log of the appraised property value of the single-family home *i* in year *t*. The predictor variables are estimated as their units. Therefore, the result can be interpreted as the percentage change of property value of single-family homes per one absolute unit change of predictor variables.

Overall, the first model turned out to be powerful - about 79.2 percent of the observations could be explained by this model. Due to the large sample size (33905 observations, 6781 single-family homes), the models were expected to be strong. Under the 95 percent confidence interval, all policy variables are significant (Figure 1). The second model for sensitivity analysis with interactive term between the distance from the LIHTC projects and the appraised year was also powerful. While all policy variables

indicating the characteristics of the nearest LIHTC projects were significant, the interactive terms of the variable (Ayr4) and the distances appeared to be extremely insignificant (Appendix 5).

Table 6.2 Result of Analysis - Policy Variables

Variable	Coefficient	Standard Error	t-value	P>t	[95% Confidence Interval]	
Dist500	-0.1139	0.009705	-11.74	0.000	-0.13292	-0.09488
Dist1000	-0.03288	0.005581	-5.89	0.000	-0.04382	-0.02195
Dist1500	-0.02004	0.004427	-4.53	0.000	-0.02871	-0.01136
Eld	-0.19477	0.047765	-4.08	0.000	-0.28839	-0.10114
Ayr1	-0.72569	0.02549	-28.47	0.000	-0.77566	-0.67573
Ayr2	-0.55876	0.025522	-21.89	0.000	-0.60878	-0.50873
Ayr3	-0.34673	0.005716	-60.66	0.000	-0.35793	-0.33552
Ayr4	-0.16311	0.005695	-28.64	0.000	-0.17427	-0.15195
Lunit	0.166997	0.025403	6.57	0.000	0.117207	0.216788
Dunit	-1.11767	0.061596	-18.15	0.000	-1.2384	-0.99694
Tunit	-0.00056	0.000055	-10.25	0.000	-0.00067	-0.00046

The models also turn out to be robust. Robustness of the model can be determined by experimenting couple of variations in explanatory variables. For both models, dropping or adding couple of variables does not change the result of analysis significantly. Also, the R-square of both models and coefficients for independent variables are almost identical even though the second model incorporated interactive terms of explanatory variables from the first model.

Nonetheless, there are a couple of issues in the model. First, three dummy variables indicating each LIHTC project is automatically dropped in the process of regression analysis. It is suspected that the three dummy variables have multicollinearity problem – having near perfect linear relationship with other independent variables. It does not affect the robustness of the entire model while it could still affect the

significance of the explanatory variables which are correlated. Although the model had multicollinearity issue with few variables, none of the variables appeared insignificant as the sample size was large enough. Also, several observations were dropped from the original dataset in the analysis. As the Census 2000 dataset is missing data of five census tracts within Austin Urbanized Area, 2014 observations out of 33905 observations were eliminated automatically while running the models with statistics software packages. It could affect the result of the analysis to some extent as the dropped observations are geographically correlated. However, it is impossible to correct the problem where there is no control over the original data sources.

ANSWERING RESEARCH QUESTIONS

The empirical analysis proved that there is no evidence that LIHTC projects in Austin have negative impacts on the property values of the neighborhood single-family property values in which the LIHTC projects are located. The coefficients of the variables indicating the appraised year (Ayr1, Ayr2, Ayr3 and Ayr4) suggests that construction of LIHTC project does not change the general trend of housing price change within its neighborhood. However, some factors related to the characteristics of LIHTC projects are indicating that they can affect the neighborhood property value detrimentally. If the size of the project is large, the project showed larger negative impact on neighborhood property values. However, the percentage of the affordable units within the LIHTC projects had positive effect. The negative impact of LIHTC projects tend to decline for the appraised single-family homes as distance from the LIHTC projects increases. Within a 500-foot radius, the property value declined most significantly. Based on the result of analysis, detailed research questions are answered below.

Differential impact of the size and the percentage of affordable units of the LIHTC projects

According to the result of the analysis, the share of the affordable units within the LIHTC projects have positive impact while the size of the LIHTC project decreases property value of neighborhood single-family homes. Number of the total units in each project had negative impact. One more unit decreased neighborhood property value by 0.056 percent. As the housing projects used for our analysis have 169.21 units in average, assuming that the impact of the size of the project in property value is linear, the size of the projects contributed to the decrease in property values by 9.4758 percent in average. The result was expected as additional housing in the neighborhood is perceived as a 'threat toward the stability of public service and amenity provision' which is the reason why neighborhoods are usually averse to new housings in the neighborhood.

Increase in percentage of the below market-rate units within LIHTC projects have positive impact on neighborhood single-family home property values. One percent increase of affordable units in LIHTC project will increase the property values by 16.69 percent. There are 18 projects which were built for 100 percent below-market rental and the average percentage of affordable units throughout 37 LIHTC projects was about 92 percent. This result is implying that the purpose of LIHTC projects - social and income mix within projects – might not be an effective strategy for improving impressions toward LIHTC projects in Austin.

Served population and the negative impact of LIHTC projects

LIHTC projects serving elderly population decreased the single-family homes property value by 19.47 percent more than the projects serving general population in the area. It was an unexpected result as it is inconsistent with the previous studies showing the differential impact of affordable housing projects by the served population. As the

supportive housings usually provide services for elderly residents, such as emergency medical service, nursing or on-site supportive programs while LIHTC projects for seniors do not have distinctive facility or different service than other multifamily housings. Therefore, it might be hard for neighbors to find the difference between LIHTC for elderly and general population which could have resulted a misleading negative impact on property value.

Percentage of units for disabled individuals showed relatively larger negative effect. Only 5.7 percent of the LIHTC projects in this study are units for disabled, however, one percent increase of those unit decreased the neighborhood single-family home property values by 19.47 percent. It is not clear why increase in units for disabled decrease the property value in neighborhood as there is no distinctive physical characteristics on those units which are noticeable from outside of the projects. However, the negative impact is small enough to be ignored.

Distance from the nearest LIHTC projects and its differential impact on property values

Property value of the single-family homes within a 2000-foot radius declined in general. The negative change of property value is significant in every distant range within a 2000-foot radius from LIHTC projects and the impact is most detrimental in a 500-foot radius. The decline in property value slows down as the single-family homes get further away from their nearest LIHTC projects. Single-family homes located within a 500-foot radius showed 11.39 percent more decrease in property value while the property value of those within a 501 to 1000-foot radius decreased by only 3.28 percent more than those within 1501 to 2000-foot radius (Table 6.2). The gap of detrimental impact between the two distance rings is larger than the gap of negative impact between a 1000-foot radius and a 1500-foot radius. However, this result does not explain whether the immediate

surrounding areas of LIHTC projects are usually in decline regardless the construction of the projects or the LIHTC projects has stronger negative impact on single-family homes which are closer to them.

Pre- and post- LIHTC project construction

Throughout the two years before and after the construction of the LIHTC projects, property values of single-family homes throughout a 2000-foot radius from LIHTC project had increased. If we assume that the property value of a single-family home appraised two years after the construction of LIHTC is 100 dollars, relative appraised values for each time period can be indicated as *figure* 6.4.

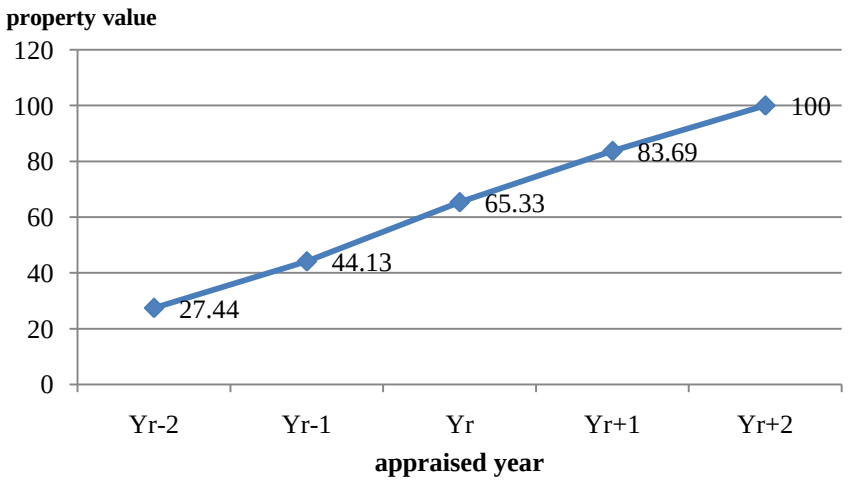

Figure 6.4 Change in Property Value of Single-Family Homes
Notes: 1) Yr= construction year of LIHTC
2) Property value in Yr+2=100

However, the rate of change in property value varied among the periods. In *figure* 6.5, the rate of change in property value throughout the study periods are shown. It indicates that the increase of property value slowed down throughout the study periods. Appraised value of single-family homes increased by 61 percent between two years before and a year before the construction of the nearest LIHTC projects while it only

increased by 19 percent two years after the construction of the projects. Most of all, the biggest drop in rate of change occurred between the construction year of LIHTC and a year after the construction – increase in property value was only 60 percent compared to the increase between the construction year and a year before the construction.

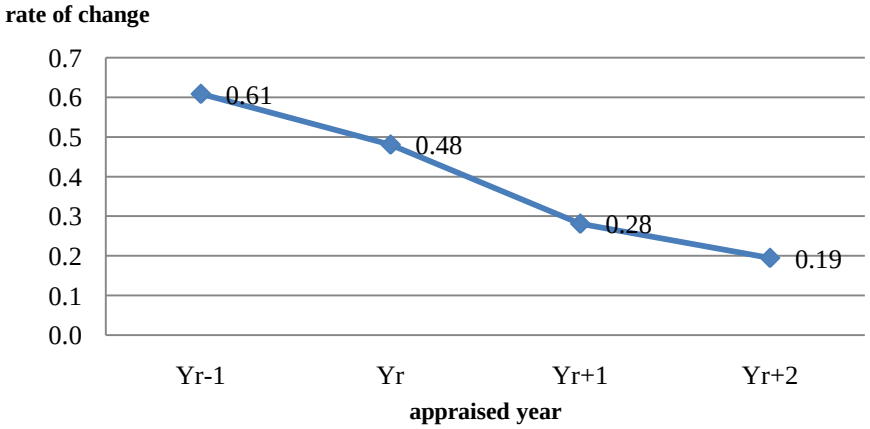

Figure 6.5 Rate of Change in Property Value of Single-Family Homes
Notes: Yr= construction year of LIHTC

To test how the distance from the LIHTC projects affect the property values before and after the LIHTC project construction, the second model introduced interactive terms of time variables (Ayr1 and Ayr4) and the distance variables (Dist500, Dist1000, Dist1500).

Table 6.3 Result of Analysis - Interactive Terms

Variable	Coefficient	Standard Error	t-value	P>t	[95% Confidence Interval]	
Ayr1_500	-0.09408	0.023813	-3.95	0.000	-0.14076	-0.04741
Ayr1_1000	-0.03678	0.013701	-2.68	0.007	-0.06364	-0.00993
Ayr1_1500	-0.02295	0.011155	-2.06	0.04	-0.04481	-0.00109
Ayr4_500	-0.00138	0.023804	-0.06	0.954	-0.04804	0.045274
Ayr4_1000	0.001669	0.013675	0.12	0.903	-0.02513	0.028472
Ayr4_1500	-0.001	0.011149	-0.09	0.929	-0.02285	0.020853

According to the result, distance from LIHTC has a significant impact on the property value strongly before the construction of the LIHTC projects while there is no significant impact of distance after the construction (Table 6.3). Assuming the property value of a single-family home located in 1501 to 2000-foot radius is 100 dollars two years before the construction of LIHTC, holding everything constant, the property value of a single-family home located within 500 feet from LIHTC project is worth 90.59 dollars (Figure 6.6).

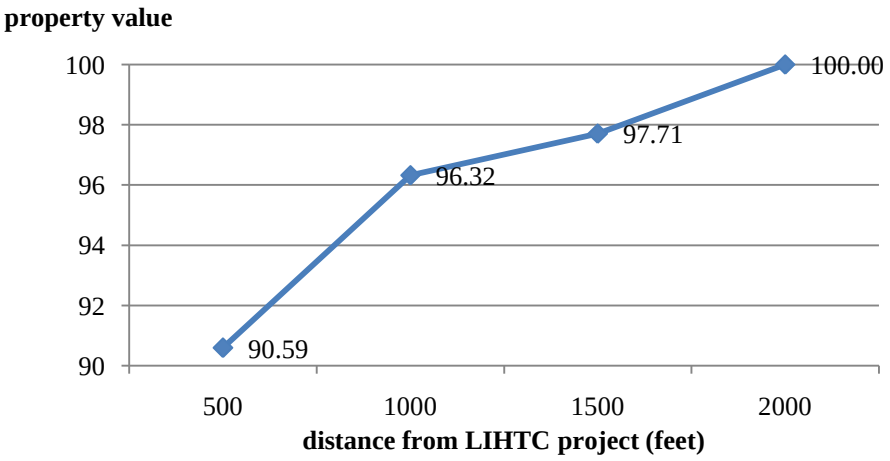

Figure 6.6 Property Value Change by Distance from LIHTC Projects
Notes: Property value in distance 2000 feet =100

Interestingly, the property value soars if the property is relocated from 500-foot radius to 1000-foot radius. In *figure* 6.7, we can see that the property value of single-family homes within a 1000-foot radius is 6.3 percent higher than the property value of those located within a 500-foot radius. It explains that the impact of LIHTC projects on neighborhood property value is stronger as it gets closer to the projects, particularly two years before the construction of the projects.

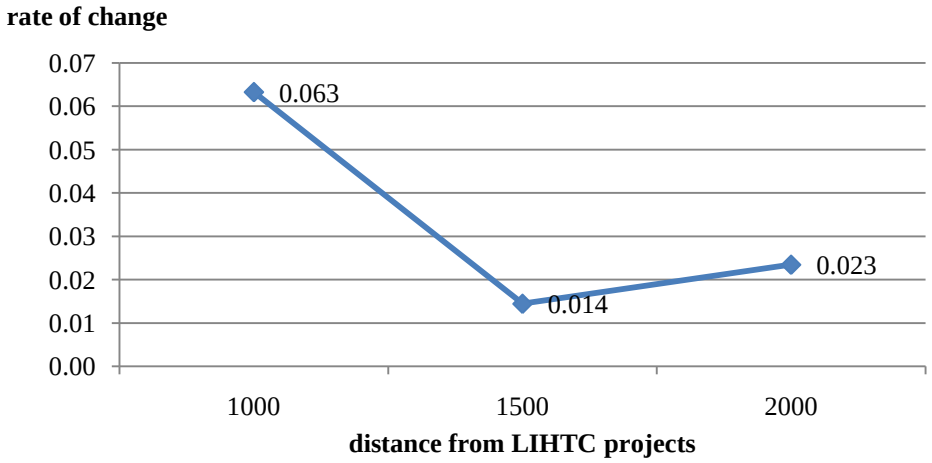

Figure 6.7 Rate of Change in Property Value by Distance from LIHTC Projects

It is suspected that the property value is affected mainly by the expectation of the potential LIHTC project within their neighborhood rather than the actual construction of the project. Moreover, the parcels for potential LIHTC projects usually stay vacant or abandoned until the project is built which is another reason for decline in property value. Most of the projects in Austin are large-scale multifamily projects which require a large parcel for development – the average size of the project is 169.22 units. The vacant large parcels within the neighborhood cannot give positive impression and it can be reflected to the single-home property value within the neighborhood.

LIMITATIONS TO METHODOLOGY

First, spatial autocorrelation was not considered thoroughly. Housing prices are affected by not only the physical characteristics of the properties or the neighborhood characteristics but also the monetary values of the adjacent properties. Can and Megbolugbe (1997) emphasized the importance of correcting spatial autocorrelation, or spatial dependency, in housing datasets. They insisted that spatial weighted average

should be calculated to correct the dependency between the values of the nearby properties.[1] In this study, spatial lag was not considered and spatial weighted average was not incorporated. It could have misled the result of analysis.

Second, even though it is possible that the number of LIHTC projects has a cumulative negative impact in property value of neighborhood single-family homes, the number of LIHTC units within 2000 feet was not adopted as an explanatory variable. The properties which are in the area where two or more LIHTC projects are within 2000-feet radius could have affected the result of analysis differently if the number of neighboring LIHTC projects is incorporated in the model instead of just choosing the nearest project.

Third, the number of adjacent multi-family housing properties within neighborhood is not identified. Generally, multi-family housings, regardless whether they are affordable housing projects or market-rated units, have detrimental impact on property value of the single-family homes within their neighborhood. If there are other multi-family housings within the defined neighborhoods, they might have affected the single-family homes property values.

Fourth, other kinds of affordable housing projects or units are not considered in this model. It is apparent that all the other different type of affordable housing programs also has similar impacts on neighborhood property values. However, no other types of affordable housing programs are included as a part of analysis.

Finally, using the S&P/Case-Schiller Housing Price Index based on national housing market might have missed some distinctive housing market trend of the study area. The housing index was estimated based on the housing sales data of the entire nation while our study is focusing on the small area.

POLICY IMPLICATION

The result of the analysis gives some policy implications to find a way to reduce potential NIMBY barricades toward LIHTC projects in Austin.

First, it is important to understand the physical trait of surrounding residential properties before deciding the size of the LIHTC projects. As the result shows, LIHTC projects with larger scale have more negative impact in neighborhood property value. It stems from ignoring the importance of harmony between the new construction and already-established neighborhood properties. Learning from the failure of the public housing due to the extremely distinctive look from other housings in neighborhoods, promoting smaller-scale LIHTC projects would be a good strategy to mitigate the negative impression toward LIHTC projects in neighborhoods.

For example, La Vista de Guadalupe, located in just east of downtown, was built in 2006 with total 22 units entirely for low- to moderate-income families. (Appendix 2 and Appendix 3) It is a relatively smaller project compared to other LIHTC projects in Austin (average size of the LIHTC projects is 169.22 units) and turned out that it had increased neighborhood property value by almost 94 percent according to the result of regression analysis. The project is two modern-looking buildings which extend the modernity of downtown streetscape to the east side of IH 35 while being integrated into the single-family home community. As it was small scale project, it did not appear to be intimidating to the immediate neighbors with single-family homes. Keeping the size of the property small and resembling the surrounding streetscapes can be considered major factor for this LIHTC project.

Second, it is crucial to consider existing number of multi-family properties in the neighborhoods when locating a new LIHTC project in neighborhoods. Placing new LIHTC projects in the neighborhoods with a decent number of multi-family housings can

be an option to reduce possible decline of property value in neighborhoods. It is an unavoidable temptation for LIHTC developers and local governments to build LIHTC projects in the areas with concentration of multi-family housings as it is easier for them to initiate a new project without facing rigorous neighborhood backlash as there are less single-family homes. However, it can cause a problem of concentration of low-income families as apartment-concentrated areas tend to show lower median household income than other parts of the city.

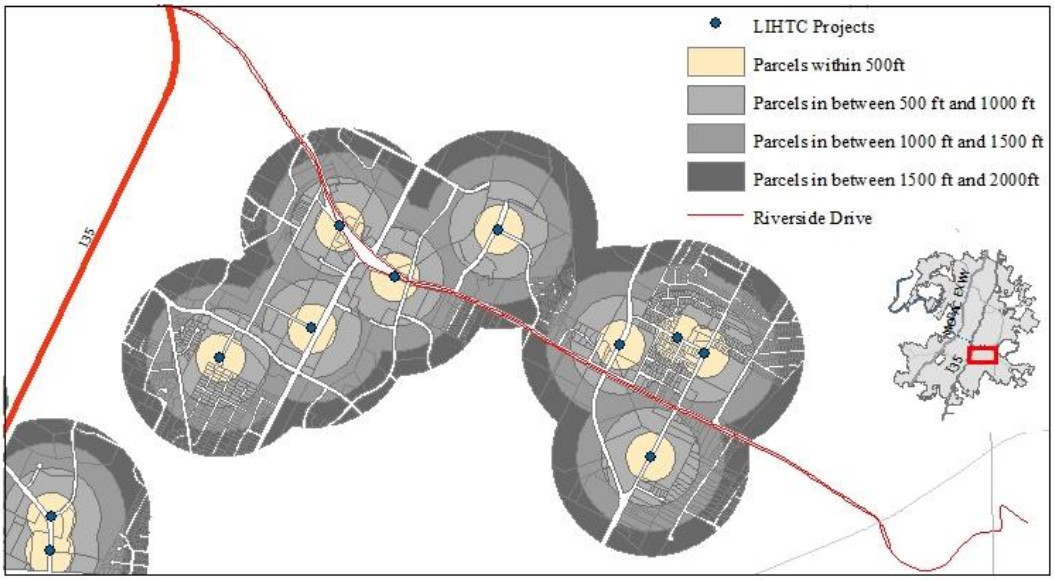

Figure 6.8 LIHTC Projects Near East Riverside Drive

There is a concentration of LIHTC projects in southeast part of Austin, so called East Riverside Area along the east Riverside Drive (Figure 6.8). This area showed the lowest median household income bracket (less than $23,786) within Austin Urbanized Area.[2] There are 9 LIHTC projects clustered within a neighborhood with a lot of multifamily housings within a 2000-foot radius from each LIHTC project. In *figure 6.4*, a lot of large-sized parcels were found around LIHTC projects, which are non-LIHTC multifamily housings - Two projects did not have any single-family homes within a

2000-foot radius. Except one project, all other projects in East Riverside area had negative impact in neighborhood single-family homes regardless of their size or served population. It exemplifies the point that concentration of LIHTC projects, especially in the area where multi-family housings are clustered can decrease the single-family homes property value.

Third, the idea of 'social mix' within LIHTC projects should be reconsidered. Originally, LIHTC was designed to mix the households with different income level within projects. The projects which acquired the tax credit are obliged to allocate at least 20 percent or more of the units for the households with less than 40 percent of the area median income or at least 40 percent or more of the units for the households with less than 60 percent of the area median income.[3] While keeping the minimum or more number of affordable units, developers can also set market-rated units to rent which will naturally induce households with various income levels. According to the result of the study, having more affordable units within a project increases the neighborhood property value. It is opposite of what the program initially expected to see through the 'income mix strategy.'

Nevertheless, it is impossible to say that income mix is ineffective as more below-market rated units have positive impact on neighborhood property value in our study as Austin has not attempted to have mixed- income LIHTC development. In Austin, about 92 percent of the units in LIHTC projects are affordable units which is a higher number than the required minimum. Regarding the difficulties in attracting people who are willing to pay market-rate rent in low-income family housing developments, developers might not be able to initiate mixed-income projects. However, the issue of social mix is very critical aspect in urban management and starting from affordable housing programs

is a good strategy. More effort and trial to create moderate social mix around affordable housing is desired in Austin.

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[1] Can and Megbolugbe, "Spatial Dependence and House Price Index Construction," *Journal of Real Estate Finance and Economics*, Vol. 14, 1997:205

[2] Figure 4.1 top left map describes the median household income in Austin Urbanized Area.

[3] The qualifications and requirements for LIHTC are thoroughly discussed in chapter 2.

Chapter7: Conclusion and Suggestion for Future Study

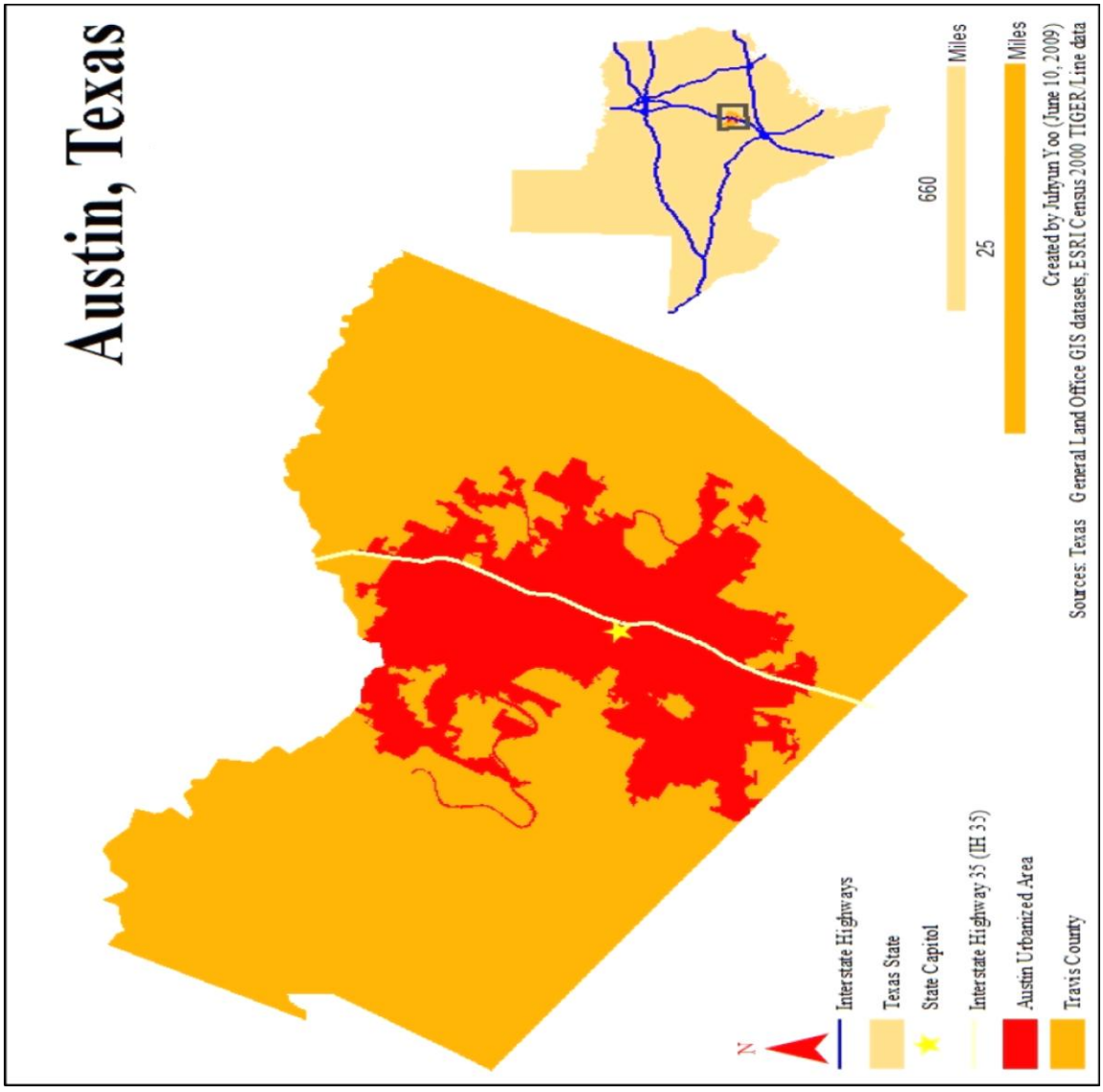
The study examined the impact of Low Income Housing Tax Credit (LIHTC) projects on property value of the neighborhood single-family home. Adopting hedonic price model to compare the impact of pre- and post- LIHTC project constructions and the differential impact between distance ranges from the LIHTC projects, two empirical models were created. Datasets for 37 LIHTC projects and 6781 single-family homes within Austin Urbanized Area were collected and used.

As a result, it was found that there is evidence that the LIHTC projects in Austin built in between 1995 and 2006 have negative impact on neighborhood property value as it affected the trend of the property value change significantly through the study period. Especially, the LIHTC projects have negative impact on immediate neighborhood property value (within a 500-foot radius) one year before construction of LIHTC projects. Size of the LIHTC projects decreased property value and percentage of the low-income housing project increased neighborhood property value. While the property value within a 2000-foot radius increased over time, the rate of change in property value slowed down throughout the study period. Also, the LIHTC properties serving elderly population had more negative impact compared to those serving general low-income families. It is an opposite result from the previous studies and conventional perceptions. Meanwhile, the result should not be adapted to other cities as the study was limited to an urbanized area and the result can vary among regions.

For the future study, controlling the impact of other types of multi-family housings including non-LIHTC affordable housing projects or private multi-family housings is suggested. Continuous impact of the number of multi-family housings within the neighborhood and the impact of other types of affordable housings needs to be

controlled for more precise analysis. Also, a structural equation model estimating the mutual impact between the property value of single-family homes and the choice of location of LIHTC projects is suggested. The model will explain how LIHTC projects can change the property value of the neighborhood in which they are located as well as how the neighborhood property value affects the location decisions of LIHTC projects.

Appendix A Location of Austin, TX



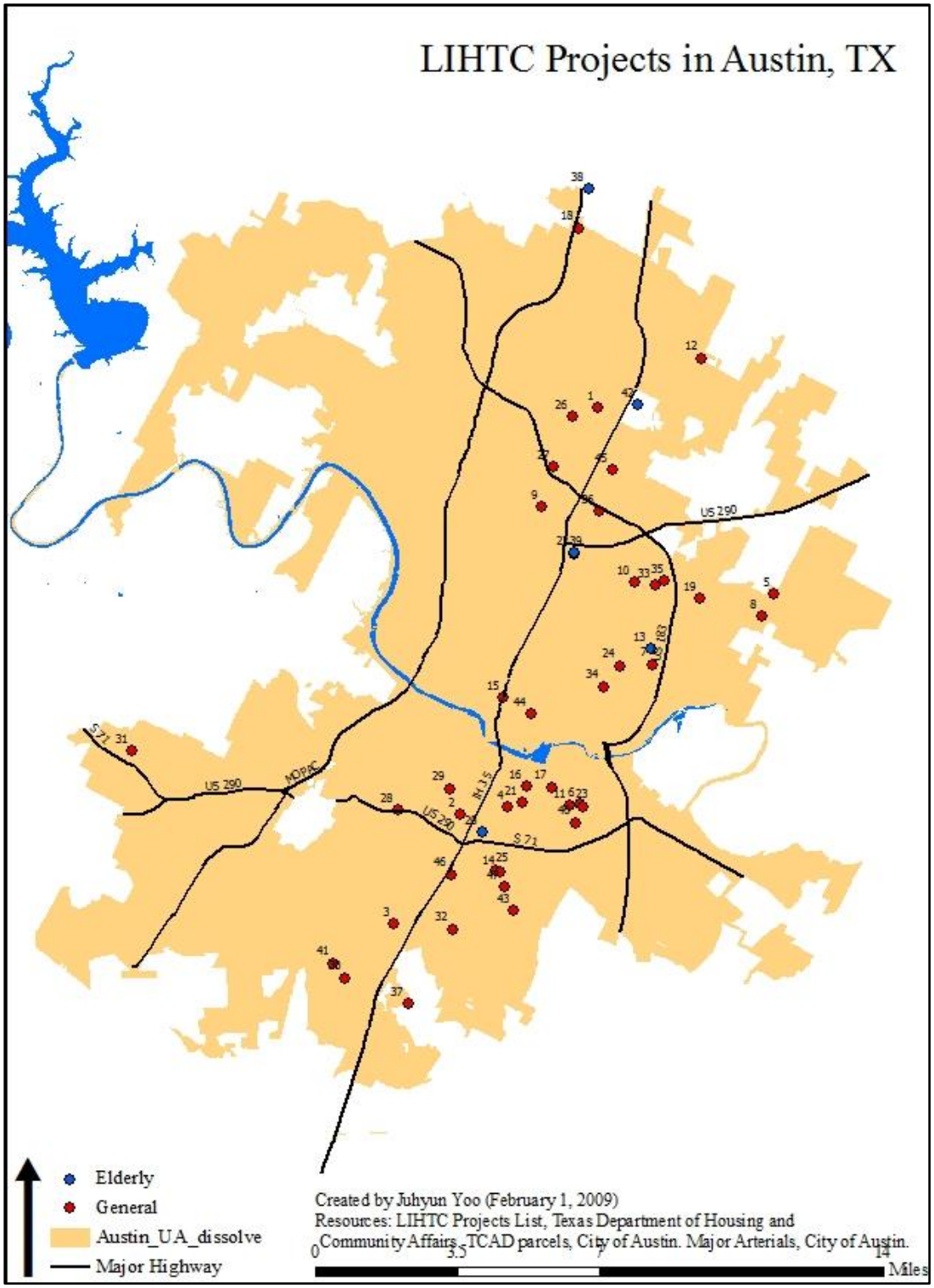
Appendix B List of the LIHTC Projects in Austin, TX

ID	Development	Population	Program Type (%)	Built Year	Total Unit	LIHTC Unit	Units for Disabled
1	Arrowhead Park Apartments	N/A	N/A	N/A	N/A	N/A	N/A
2	Blunn Creek Apartments	General	4	2001	280	280	28
3	Circle S Apartments	General	4	2001	200	200	0
4	Douglas Landings	General	9	1997	96	96	16
5	Eagle's Landing Apartments	General	4	2002	240	240	0
6	Fairway Village	General	4	2000	128	127	0
7	Fort Branch Landing Apartments	General	4	2000	250	248	0
8	Gardens Of Decker Lake	General	9	1996	200	150	24
9	Gateway Apartments	N/A	N/A	N/A	N/A	N/A	N/A
10	Greentree Apartments	N/A	N/A	N/A	N/A	N/A	N/A
11	Grove Place Apartments	General	9	2003	184	146	18
12	Harris Branch Apartments	General	4	2005	248	248	0
13	Heritage Pointe	Elderly	9	2003	240	192	0
14	King Fisher Creek	General	9	2004	35	35	4
15	La Vista de Guadalupe	General	9	2006	22	22	0
16	Mountain Ranch Apartments	General	4	1999	196	196	30
17	Paradise Oaks Apartments	N/A	N/A	N/A	N/A	N/A	N/A
18	Park at Summer Grove FKA Center	General	4	2003	240	240	0
19	Park Place at Loyola	N/A	N/A	N/A	N/A	N/A	N/A
20	Parker Lane Seniors Apartments	Elderly	9	2005	70	68	5
21	Pleasant Hill Apartments	N/A	N/A	N/A	N/A	N/A	N/A
22	Primrose of Shadow Creek	Elderly	4	2001	176	174	0
23	Riverside Meadows	General	4	2001	248	248	25
24	Rollins Martin	General	9	1996	16	15	3
25	Rosemont at Williamson Cree	General	9	2002	163	130	12
26	Runnymede Apartments	General					
27	Santa Maria Village Apartments	General	4	2000	176	175	1
28	Skyline Terrace	General	9	2006	100	100	18
29	South Congress Apartments	General	4	2000	172	170	0
30	Southpark Apartments	General	4	2006	192	192	0
31	Southwest Trails	General	4	2000	160	160	12
32	Spring Valley Townhomes	General	9	1999	230	173	23
33	Springdale Apartments	General	4	2000	98	97	1
34	Springdale Estates	General	9	2001	43	25	3
35	Springhollow Apartments	N/A	N/A	N/A	N/A	N/A	N/A
36	St. John's Village	General	9	1998	156	117	25
37	The Residences at Onion Creek	N/A	N/A	N/A	N/A	N/A	N/A
38	The Lodge at Merriltown	N/A	N/A	N/A	N/A	N/A	N/A
39	Timbers	General	9	1996	104	78	17
40	Town Vista Apartments	General	4	2002	280	280	0
41	Trails at the Park	General	9	1998	200	148	12
42	Village at Collinwood	Elderly	4	1999	174	174	0

43	Villas of Cordoba	General	9	2000	156	93	16
44	Villas on Sixth Street	General	9	2004	160	136	12
45	Windcrest Parkside Apartments	General	9	1995	228	228	34
46	Woodway Square Apartments	General	4	2002	240	240	0
47	Woodway Village Apartments	General	4	2002	160	160	16

Notes: The only LIHTC projects constructed between 1995 and 2006 are listed above.

Appendix C Map of the LIHTC project



Appendix D Result of Regression Analysis (Model 1)

Dependent variable= lnPV
R-squared=0.7925

variables	coefficient	standard error	t	P>t	[95% Confidence Interval]	
AMI	1.27E-06	4.98E-07	2.56	0.01	2.97E-07	2.25E-06
DCBD	1.04E-05	8.84E-07	11.8	0.00	8.70E-06	1.22E-05
numfire	0.310146	0.014924	20.78	0.00	0.280894	0.339397
numbath	0.308945	0.015837	19.51	0.00	0.277903	0.339986
numgarage	0.123123	0.005519	22.31	0.00	0.112306	0.133939
area	4.21E-06	1.70E-07	24.68	0.00	3.87E-06	4.54E-06
Dist500	-0.1139	0.009705	-11.74	0.00	-0.13292	-0.09488
Dist1000	-0.03288	0.005581	-5.89	0.00	-0.04382	-0.02195
Dist1500	-0.02004	0.004427	-4.53	0.00	-0.02871	-0.01136
Age	-0.00131	7.27E-05	-17.97	0.00	-0.00145	-0.00116
Hisp	-0.47238	0.027594	-17.12	0.00	-0.52647	-0.4183
Black	-0.10072	0.036069	-2.79	0.01	-0.17141	-0.03002
Eld	-0.19477	0.047765	-4.08	0.00	-0.28839	-0.10114
Ayr1	-0.72569	0.02549	-28.47	0.00	-0.77566	-0.67573
Ayr2	-0.55876	0.025522	-21.89	0.00	-0.60878	-0.50873
Ayr3	-0.34673	0.005716	-60.66	0.00	-0.35793	-0.33552
Ayr4	-0.16311	0.005695	-28.64	0.00	-0.17427	-0.15195
Lunit	0.166997	0.025403	6.57	0.00	0.117207	0.216788
Dunit	-1.11767	0.061596	-18.15	0.00	-1.2384	-0.99694
Tunit	-0.00056	0.000055	-10.25	0.00	-0.00067	-0.00046
D2	0.328702	0.034864	9.43	0	0.260368	0.397036
D3	-0.21176	0.013895	-15.24	0	-0.239	-0.18453
D4	-0.62115	0.02356	-26.37	0	-0.66733	-0.57497
D5	-0.40796	0.146556	-2.78	0.005	-0.69522	-0.12071
D6	-0.53585	0.018231	-29.39	0	-0.57158	-0.50011
D7	-0.63506	0.02171	-29.25	0	-0.67761	-0.59251
D8	-1.17254	0.084664	-13.85	0	-1.33848	-1.00659
D11	0.32638	0.028761	11.35	0	0.270008	0.382752
D12	-0.18591	0.086088	-2.16	0.031	-0.35465	-0.01718
D13	0.164259	0.049618	3.31	0.001	0.067006	0.261512
D14	0.561867	0.044544	12.61	0	0.47456	0.649175
D15	0.936196	0.027995	33.44	0	0.881325	0.991067
D16	-0.057	0.037342	-1.53	0.127	-0.13019	0.016194
D18	(dropped)					
D20	0.824989	0.0529	15.6	0	0.721303	0.928675

D22	(dropped)					
D23	-0.40884	0.017388	-23.51	0	-0.44292	-0.37476
D24	-1.49227	0.019111	-78.08	0	-1.52973	-1.45482
D25	-0.03341	0.03269	-1.02	0.307	-0.09748	0.030666
D27	-0.3817	0.02293	-16.65	0	-0.42664	-0.33676
D28	0.727773	0.021358	34.08	0	0.685911	0.769635
D29	0.09003	0.021825	4.13	0	0.047253	0.132807
D30	0.332223	0.031314	10.61	0	0.270847	0.393599
D31	-0.48405	0.053284	-9.08	0	-0.58849	-0.37961
D32	-0.61414	0.013285	-46.23	0	-0.64018	-0.5881
D33	-0.34278	0.016397	-20.91	0	-0.37492	-0.31064
D34	-0.27829	0.018873	-14.75	0	-0.31529	-0.2413
D36	-0.78777	0.015471	-50.92	0	-0.81809	-0.75745
D38	(dropped)					
D39	-0.68081	0.018313	-37.18	0	-0.7167	-0.64491
D40	-0.24916	0.024829	-10.04	0	-0.29783	-0.2005
D41	-0.66559	0.016018	-41.55	0	-0.69698	-0.63419
D42	-0.9398	0.095755	-9.81	0	-1.12749	-0.75212
D43	-0.20625	0.013366	-15.43	0	-0.23245	-0.18005
D44	0.377672	0.022401	16.86	0	0.333766	0.421579
D45	-0.92865	0.021078	-44.06	0	-0.96996	-0.88734
D46	-0.07023	0.017725	-3.96	0	-0.10497	-0.03549
constant	11.51868	0.056219	204.89	0	11.40849	11.62887

Appendix E Result of Regression Analysis (Model 2)

Dependent variable= lnPV
R-squared=0.7926

Variables	coefficient	standard error	T	P>t	[95% Confidence Interval]	
AMI	1.27E-06	4.98E-07	2.56	0.011	2.98E-07	2.25E-06
DCBD	1.04E-05	8.84E-07	11.79	0	8.69E-06	1.22E-05
Numfire	0.312064	0.014939	20.89	0	0.282784	0.341345
Numbath	0.309052	0.015833	19.52	0	0.278018	0.340085
Numgarage	0.123139	0.005517	22.32	0	0.112326	0.133953
Area	4.21E-06	1.70E-07	24.68	0	3.87E-06	4.54E-06
Dist500	-0.09481	0.01228	-7.72	0	-0.11887	-0.07074
Dist1000	-0.02587	0.007057	-3.67	0	-0.03971	-0.01204
Dist1500	-0.01525	0.005658	-2.7	0.007	-0.02634	-0.00416
Age	-0.00131	7.27E-05	-17.98	0	-0.00145	-0.00116
Hisp	-0.47229	0.027587	-17.12	0	-0.52636	-0.41822
Black	-0.10064	0.03606	-2.79	0.005	-0.17131	-0.02996
Eld	-0.1946	0.047753	-4.08	0	-0.28819	-0.101
Ayr1	-0.70633	0.025936	-27.23	0	-0.75717	-0.65549
Ayr2	-0.55435	0.025536	-21.71	0	-0.60441	-0.5043
Ayr3	-0.34679	0.005715	-60.68	0	-0.35799	-0.33559
Ayr4	-0.16304	0.00702	-23.23	0	-0.1768	-0.14928
Lunit	0.169431	0.025406	6.67	0	0.119634	0.219227
Dunit	-1.11352	0.06163	-18.07	0	-1.23432	-0.99272
Tunit	-0.00055	5.51E-05	-9.97	0	-0.00066	-0.00044
D2	0.327657	0.034856	9.4	0	0.259338	0.395976
D3	-0.21177	0.013892	-15.24	0	-0.239	-0.18454
D4	-0.62105	0.023553	-26.37	0	-0.66722	-0.57489
D5	-0.40822	0.146517	-2.79	0.005	-0.69539	-0.12104
D6	-0.53536	0.018227	-29.37	0	-0.57109	-0.49963
D7	-0.63557	0.021704	-29.28	0	-0.67811	-0.59303
D8	-1.17245	0.084642	-13.85	0	-1.33835	-1.00655
D11	0.326459	0.028753	11.35	0	0.270102	0.382817
D12	-0.18613	0.086065	-2.16	0.031	-0.35482	-0.01743
D13	0.163954	0.049605	3.31	0.001	0.066727	0.261182
D14	0.562868	0.044533	12.64	0	0.475582	0.650154
D15	0.937412	0.027991	33.49	0	0.882547	0.992276
D16	-0.0575	0.037332	-1.54	0.123	-0.13067	0.01567
D18	(dropped)					
D20	0.825629	0.052886	15.61	0	0.721971	0.929288

D22	(dropped)					
D23	-0.4096	0.017385	-23.56	0	-0.44367	-0.37552
D24	-1.49127	0.019108	-78.04	0	-1.52873	-1.45382
D25	-0.03309	0.032681	-1.01	0.311	-0.09714	0.03097
D27	-0.3815	0.022924	-16.64	0	-0.42643	-0.33657
D28	0.728079	0.021352	34.1	0	0.686227	0.76993
D29	0.090129	0.021819	4.13	0	0.047363	0.132895
D30	0.33235	0.031306	10.62	0	0.27099	0.39371
D31	-0.48377	0.05327	-9.08	0	-0.58818	-0.37936
D32	-0.61431	0.013283	-46.25	0	-0.64035	-0.58828
D33	-0.342	0.016395	-20.86	0	-0.37414	-0.30987
D34	-0.2767	0.018872	-14.66	0	-0.31369	-0.23971
D36	-0.78749	0.015468	-50.91	0	-0.81781	-0.75717
D38	(dropped)					
D39	-0.68022	0.018309	-37.15	0	-0.71611	-0.64433
D40	-0.24992	0.024823	-10.07	0	-0.29858	-0.20127
D41	-0.6653	0.016014	-41.54	0	-0.69669	-0.63391
D42	-0.93964	0.09573	-9.82	0	-1.12727	-0.752
D43	-0.20561	0.013364	-15.39	0	-0.23181	-0.17942
D44	0.377805	0.022395	16.87	0	0.33391	0.4217
D45	-0.93022	0.021081	-44.13	0	-0.97154	-0.8889
D46	-0.07065	0.01772	-3.99	0	-0.10538	-0.03592
Ayr1_500	-0.09408	0.023813	-3.95	0	-0.14076	-0.04741
Ayr1_1000	-0.03678	0.013701	-2.68	0.007	-0.06364	-0.00993
Ayr1_1500	-0.02295	0.011155	-2.06	0.04	-0.04481	-0.00109
Ayr4_500	-0.00138	0.023804	-0.06	0.954	-0.04804	0.045274
Ayr4_1000	0.001669	0.013675	0.12	0.903	-0.02513	0.028472
Ayr4_1500	-0.001	0.011149	-0.09	0.929	-0.02285	0.020853
Constant	11.5109	0.056237	204.68	0	11.40067	11.62113

Appendix F Data Sources for Analysis

GIS Datasets

1. Texas General Land Office (GLO)GIS Data
   http://www.glo.state.tx.us/gisdata/gisdata.html
   - County Boundaries
   - Roads/Highways

2. ESRI Census 2000 TIGER/Line Data
   http://www.esri.com/data/download/census2000_tigerline/index.html
   - Census 2000 Travis County Block Group

3. City of Austin GIS Datasets
   ftp://coageoid01.ci.austin.tx.us/GIS-Data/Regional/coa_gis.html
   - County Boundary
   - Street Centerlines
   - TCAD Parcels

4. Capital Area Council of Governments
   http://www.capcog.org/information-clearinghouse/geospatial-data/
   - Hydrography

Statistical Datasets

1. Travis Central Appraisal District (TCAD)
   - Appraisal Data of Travis County between 1993 and 2008

2. U.S. Census Bureau
   - U.S. Census 2000 Block Group Sample Data 3 (SF3)

3. Texas Department of Housing and Community Affairs (TDHCA)
   - Low-Income Housing Tax Credit Inventory, 1991-2008

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